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COLOPHON

EAZA News is the quarterly magazine of the European Association of Zoos and Aquaria (EAZA)

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Specialist Committee Chairs as observers in Council

Gordon McGregor Reid, Chester Zoo · Jacques Kaandorp, Safaripark Beekse Bergen (Hilvarenbeek) · Henk Hiddingh, Emmen Zoo

FARE WELL AND THANK YOU

At the EAZA Conference in Warsaw it was announced that Corinne Bos is leaving the organisation. After ten and a half years of dedication and commitment, Corinne Bos decided to look for new challenges.

Corinne Bos not only devoted ten years to EAZA, she has played a very important part in shaping – and to some extent guarding – what EAZA is all about, and how the Executive Office contributes to all of this.



Corinne Bos was conference coordinator for nine EAZA conferences and organised, prepared and wrote the minutes of twenty Council meetings. She has been an office liaison to several committees (e.g. Membership and Ethics Committee, Education Committee, Conservation Committee) and for ALPZA. She was involved in setting up and implementing the EAZA Accreditation Procedure and, in addition, she was office rapporteur for 27 screening missions in 13 countries. She co-developed the concept of the EAZA Conservation Campaigns and played a principal role in five successful campaigns. Last but not least she contributed to about forty issues of EAZA News.

We can speak for all of us, when we express the hope that the European zoo and conservation world will in some way or another be able to continue to benefit from Corinne Bos' experience and dedication.

Corinne, thank you very much and lots of success for the future!

MEMBER OF



IUCN
The World Conservation Union

EAZA EXECUTIVE OFFICE

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PHOTO PETER RYNGAERT



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PHOTO GRIESBACH



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PHOTO ERIC BORNEMAN

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COVER *Phyllorhiza punctata*
PHOTO ZOO AQUARIUM BERLIN*Myrripristis jacobus*
PHOTO BRENNAN HERNANDEZ/SHEDD AQUARIUM

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03

FROM THE EAZA OFFICE

24th EAZA Annual Conference

This year's EAZA Annual Conference was kindly hosted by Warsaw Zoo, Poland. On 12 September the conference was officially opened by the director of Warsaw Zoo, Jan Maciej Rembiszewski and the Warsaw Minister of Natural Environment, both welcoming 570 participants. Other speakers during the opening session included Bert de Boer (chair EAZA), Bengt Holst (chair EEP Committee) and Harry Schram (executive director EAZA).

The succeeding four conference days included many presentations, meetings and workshops. Plenary sessions dealt with the EAZA Conservation Campaigns, visitor studies and practical examples of sustainability in zoos. The EAZA AGM on 15 September was followed by the official closure of the conference, during which Jan Maciej Rembiszewski handed over the 'EAZA Annual Conference Flag' to Zjef Pereboom, representing next year's host, the Royal Zoological Society of Antwerp, Belgium. The next EAZA Annual Conference will be held from 16 to 21 September 2008.

A climate-neutral conference

...that is what EAZA tried to achieve. Climate change is a big threat to global biodiversity conservation. Therefore this year each conference participant has paid a small climate compensation fee, which resulted in a total fee of €5,775.30. This fee is paid to the international Greenseat programme, which will use it in green forestry and sustainable energy projects. For more information on these projects, please refer to www.greenseat.com.



Four new EAZA Council members

Four new council members were appointed during the EAZA Council meeting on 14 September 2007: Vladimir Topchy (Nikolaev Zoo), Davorka Maljkovic (Zagreb Zoo), Michael Martys (Innsbruck Zoo) and Shai Doron (Jerusalem Zoo).

Membership news

Six new EAZA members were approved during the EAZA Council meeting on 14 September 2007. Currently, EAZA has 307 members; please refer to the 'Welcome' section on page 5 for more information on the newly approved members.

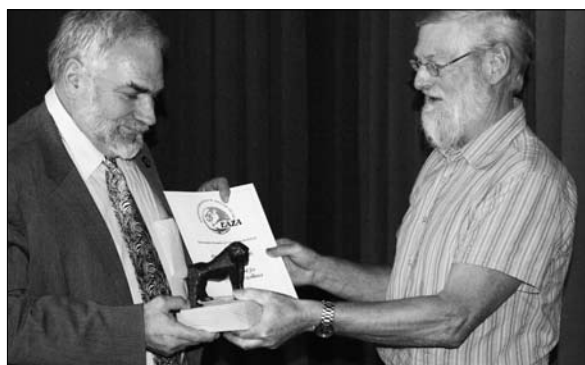
Furthermore, the Breeding Centre for Endangered Arabian Wildlife (Sharjah) was upgraded to full member (former associate member), after the 2007 AGM decided that zoos and aquariums in the United Arab Emirates, though located outside Europe, can also apply for full membership.

EAZA Awards

During the EAZA AGM 2007, six bronze gorilla awards were presented by Bert de Boer, chair of EAZA. These 2007 EAZA Awards were given to:

Professional Excellence

- **Christian Schmidt** received an EAZA Award for Professional Excellence for his important role within the European zoo community. Christian first worked in Zürich and later in Frankfurt zoos, and was one of the 'founding fathers' of the EEPs and, as such, also of EAZA.



- **Miranda Stevenson** received an EAZA Award for Professional Excellence for over thirty years of hard work and dedication to cooperation in the zoo community. Miranda first worked in Edinburgh Zoo and Marwell Zoo and now directs the British and Irish Association of Zoos and Aquaria.



Institutional Excellence

- **Copenhagen Zoo** was awarded with an **EAZA Conservation Award** for its global investment in *ex situ* and *in situ* conservation.
- **London Zoo (ZSL)** was awarded with the **EAZA Sustainability Award** for the sustainable construction of the Gorilla Kingdom.
- **Chester Zoo** was awarded with the **EAZA Research Award** for being an important research facility with an essential role in many areas of biological research.
- **Prague Zoo** received an **EAZA Award** for its hard work during recent years, as the zoo has almost completely been rebuilt since the disastrous flood in 2002.

Ree Park - Ebeltøft Safari

Mr. Jesper Stagegaard
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FULL MEMBER

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Founded: 1998
Size: 70 ha
Staff: 29
Number of species: 95
Paid attendance: 73,400 (2006)
Organisational type: private institution

Ree Park - Ebeltøft Safari started as a family park with playgrounds and pet animals. The park began focusing on housing (wild) animals in 1998, and a development plan for a safari park was established. Over the years the zoo has undergone many changes and international standards for modern zoos have been incorporated in the daily routines. The zoo was divided into geographical zones in 2000 and guided drives through the safari park began in 2001. Plans for the upcoming years include the construction of a new showroom for exhibitions and educational purposes, new carnivore exhibits and a new education centre.

Parc Zoologique de Trégomeur

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Date of opening: 28 April 2007
Size: 12 ha
Number of species: 35
Organisational type: private institution
Staff: 10

Parc Zoologique de Trégomeur first opened in 1966. Created by Mr. Arnoux, the park was run by the Arnoux family until the founder died in 2002. The Côtes d'Armor Department bought the park in 2003 and hired staff of EAZA member institution La Bourbansais (Pleugeneuc, France) to develop and manage the park. Then the park closed temporarily for renovation, reopening on 28 April 2007 with an animal collection completely focusing on Asian species. This theme was chosen because of the French explorer, Auguste Pavie, who travelled frequently to Asia.

Stiftelsen Atlanterhavsparken (The Atlantic Sea Park)

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Open to the public: 15 June 1998
Size: 0.4 ha exhibition area;
0.25 ha off-exhibit; 0.6 ha outdoor area
Staff: 7
Number of species: 63 fish,
50 invertebrates
Paid attendance: 100,400 (2006)
Organisational type: foundation since 1976

The Atlantic Sea Park is situated 3.5 km west of Tueneset centre and focuses on marine life in the northern Atlantic Ocean. Facilities include ten large landscape aquariums, a large open sea tank, ten smaller aquariums and a deep sea exhibition. During the past five years a new café has been built, the public area has been redecorated, all information signs have been updated and many new exhibits have been opened. Several exhibits are due to be built (e.g. seal exhibit, tropical exhibit, arctic exhibit) in the next five years, and construction of a research laboratory and an educational room are included in future plans.

Toruń Zoobotanical Garden

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EAZA shortname: TORUN



Founded: 1965
Size: 3.8 ha
Staff: 15
Number of species: 77
Paid attendance: 47,000 (2006)
Organisational type: public institution,
funded by local authorities

The Zoobotanical Garden of Toruń is owned and operated by the city of Toruń and houses an animal collection ranging from pheasants to primates to snakes. However, the management prefers to particularly focus on birds and small mammals in the future. Given the limited size of the zoo, this would provide animals with the optimal space needed. Staff members are actively involved in *in situ* conservation work with common mergansers (*Mergus merganser*) in the county of Toruń and conservation of old Polish apple cultivars.

International Bear Foundation (IBF)

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EAZA shortname: ORG-IBF



International
Bear Foundation

Founded: 2005
Staff: 1 part-time director
(office and fundraising activities
are supported by Zodiac Zoos)
Organisational type: foundation

The International Bear Foundation was founded in 1993 by Gerard Baars, former chair of the board of Ouwehands' Dierenpark, the Netherlands, and was re-initiated by him in 2005. The goals of the foundation are to protect endangered bear species and their natural habitat, with a focus on brown bears living in Europe and Asia. Although the 'new' International Bear Foundation has a short history, much was accomplished in 2006. One of the focus areas has been Georgia, where discussions have been initiated with national authorities concerning the 'street bears'. This has so far resulted in a commitment to create a sanctuary and the actual construction is due to start within a few months from now.

Leibniz Institute for Zoo and Wildlife Research (IZW)

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EAZA shortname: ORG-IZW



Founded: 1992
Staff: 130 (incl. PhD students)
Organisational type: publicly/
governmentally funded independent
academic research institute

This institution has a history of close cooperation with both zoological gardens and conservation organisations throughout the world. It has the necessary veterinary, biological and evolutionary expertise to work on both captive and free-ranging populations. The IZW motto 'evolutionary wildlife research for conservation' is put into practice by developing many national and international cooperative relationships with non-governmental organisations, breeding facilities, zoological gardens, national parks and reserves. Currently, IZW cooperates with more than 50 zoos in Europe, North America and Asia. Over the years it has expanded its zoo-based research efforts, particularly in the field of assisted reproduction and its engagement in international efforts (e.g. EEPs). By becoming an EAZA member, IZW has now formally committed itself to the zoo community.

We welcome new members and look forward to a fruitful cooperation. We are convinced that our new members will benefit from the membership services which EAZA offers as a strong pan-European zoo and aquarium organisation. At the same time, we would like to introduce the new members to the readers of EAZA News by providing some general information.



EAZA MADAGASCAR CAMPAIGN

More than €450,000 raised for Madagascar!

The sum of **€450,635.81** is the fantastic preliminary result of the fundraising efforts for Madagascar! Many thanks to all EAZA members that supported the campaign by raising funds and organising awareness and education activities. The original campaign target was €500,000, and with several participants continuing their efforts and thus more contributions expected, this target will certainly be reached before the end of the year. The preliminary results mean that we will be able to support all twenty selected campaign projects with the amounts pledged at the start of the campaign. Messages have been sent out to all selected projects to inform them of the good news and to make arrangements for the first money transfers. An additional amount of €25,000 was already sent to Madagascar as emergency support to recover from the damage caused by several cyclones earlier in 2007. The Madagascar Campaign Planning Group is considering various options for the remaining funds, and will keep all participants updated via the website and EAZA News.

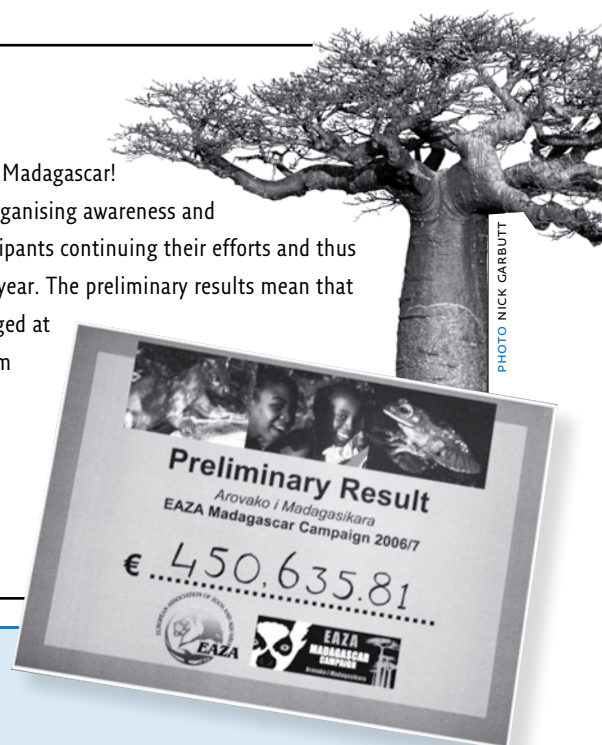


PHOTO NICK CARBUTT

EAZA Cyclone Appeal update

Due to the devastating series of cyclones that affected Madagascar earlier in the year the campaign planning group made an emergency appeal for funds. A remarkable **€25,000** was pledged by concerned zoos and charities in 24 hours. This sum was forwarded to the Wildlife Conservation Society, working in the Makira/Masoala forest blocks in the north-east of the country, one of the most badly affected areas. Here damage was sustained to the national park infrastructure as well as to the local communities, many of which witnessed substantial damage to their homes and crops.

The EAZA funds have been spent in the following ways;

Masoala:

- Compensation (allowance) to park staff based in Altalaha, where property (houses) was lost *[completed]*
- Repairs to park infrastructure (repairs to nine ranger posts) *[ongoing]*
- Repairs to tourism infrastructure (tent shelters and sign posts) *[ongoing]*
- Repairs to communications/radio network *[ongoing]*

- Creation of firebreaks in three detached parks *[completed]*
- Repairs to irrigation systems in communities (four sites) *[ongoing]*

All the work carried out in the park was undertaken by local communities, thus bringing them a welcome extra income source in addition to safeguarding the Masoala National Park, home to an estimated 50% of all the biodiversity of Madagascar.

Projects were also carried out in Makira;

Makira:

- Rehabilitation and new construction of irrigation systems in the community resource management sites of Ambodivohangy. *[ongoing, with completion by end of year]*. Impact: 330 ha of rice field irrigated; 2,140 community members benefit. System will improve planting that will occur in December and harvest in May 2008.
- Installation of a well for drinking water in the community resource management site of Marovovoana *[ongoing]*.

Thanks to all those who responded so promptly in the face of this crisis!

Madagascar was his life – An obituary for Mario Perschke

In June 2007 we learned that Mario Perschke, born in 1967 in what was then East Berlin, had been found dead near Mahajanga on Madagascar. Our fears of the last months suddenly made way to an inconsolable truth.

Mario worked for Berlin Tierpark for several years and his special interest in lemurs also took him to Saarbrücken Zoo for a while. During the 1990s, Mario's frequent travels to

Madagascar lead him to initiate a consistent programme to turn Antananarivo Zoo into a centre for conservation. In this goal, he was supported by Vogelpark Walsrode and the Brehm Fund.

In 2005 Mario, together with ZGAP and other NGOs, founded the 'Voronosy' Association, for the conservation of biodiversity in Bombetoka Bay. In the mean time

he had settled permanently in his adopted country and soon managed to gain the respect of the President of Madagascar. In 2006, German federal president Köhler visited Mario's zoo in Tsimbazaza and one year later Mario accompanied the Madagascar president to Germany. Tragically however, at this climax of his professional commitment, Mario returned to Madagascar only to loose all perspective for his private life.

Along with the the entire conservation movement, Mario's friends and colleagues lose a genuine and determined brother-in-arms in their fight for the preservation of biodiversity. All that is left for us now is to wish Mario all the peace he could not find in our world.

Thank you, Mario!

H. Jörg Adler, Münster

Madagascar Campaign Special Awards

Fundraising was not the only target of the EAZA Madagascar Campaign. Education and awareness about the magnificent island have been just as important. Therefore an **EAZA Education Award** was handed out to the participating institution that developed the most original education programme about Madagascar.

WINNER: MULHOUSE ZOO

Mulhouse Zoo received a special award for developing a whole range of activities focusing on education and awareness. The 'lemur-camp' for children in the zoo was very detailed and especially got the planning group's attention. The lemur-camp participants spent a whole day in the zoo tracking and observing the lemurs.

RUNNER UP: PARCO NATURA VIVA

This institution organised a whole range of education activities as well. The most innovative idea was a Malagasy book showing the wonderful flora and fauna of Madagascar and the threats to their survival through Malagasy children's eyes by means of drawings.

As not all zoos have the same potential for raising funds, an **EAZA Fundraising Award** was also available for the participating institution that developed the most innovative fundraising idea. The amount of money raised by the activity was not taken into account.

WINNER: BLACKPOOL ZOO

Blackpool Zoo developed a theatre show with diverse Malagasy animals and folk tales. The Blackpool Zoo team threw their hearts and souls into this show. The team created several characters including a ring-tailed lemur, green turtle, elephant bird, and poacher. The show was based on the theme of pirates arriving on Madagascar, reflecting the colourful history of the island. Funds were raised by contributions from spectators.

RUNNER UP: PLZEN ZOO

A large outreach programme was set up by Plzen Zoo, including a Malagasy film that played in all city busses during the campaign. This meant that even citizens of Plzen who did not get to the zoo found out about the campaign and the ways in which they could help biodiversity on Madagascar.

And finally an **EAZA Community Impact Award** was given to participating institutions that developed the best community outreach programme. The EAZA Madagascar Campaign tried to involve the people of Madagascar as much as possible, for example by organising the painting and drawing competition and connecting participating institutions with Malagasy radio stations.

WINNER: BRISTOL ZOO

Bristol Zoo developed a programme reaching out to children in Madagascar. The programme included a linking scheme between schools in Bristol and Madagascar. The schools in Madagascar are near the AEECL Sahamalaza Project and currently two Bristol schools are linked to schools in Madagascar. The children of the schools communicate with each other by sending images of their day to day lives, proving that language is not a barrier. Bristol hopes to have five schools in Bristol participating in this scheme by the end of 2007.

RUNNER UP: NEWQUAY ZOO

The 'Miles for Madagascar' initiative was also an entertaining activity. Two zoo staff tried to get as far away from the zoo as they could in 72 hours without any money, requiring them to hitch-hike, arrange free train tickets and so on. Funds were raised by sponsors that donated an amount for every mile distance the two staff could put between themselves and the zoo.

A special award for 'outstanding efforts' was given to Woburn Safari Park. This institution was the first (and so far the only) to raise over **€40,000** and thus qualified for the red fundraising certificate. Various activities were organised in Woburn during the year, including a special zoo night during which all zoo staff worked for free and proceeds went to the Madagascar campaign.

All winners and runners-up received a special certificate in recognition of their efforts. In addition to this, the prize winners received a gecko sculpture made by Linda Wandel, a Danish ceramist. The sculptures were kindly donated by Linda Wandel and Terrarium Vissenbjerg, which had offered similar sculptures for sale during the campaign to raise funds. Blackpool Zoo received a lemur drawing made by a Malagasy artist, which was donated by Zürich Zoo. On top of all this, all winners received a signed copy of the book 'Mammals of Madagascar' by the famous photographer Nick Garbutt.

Every year, the special awards are selected based on applications sent in. This year there was a high number of applications, so the planning group had to make some tough choices. Remarkably almost half of the applications came from the United Kingdom. The upcoming Amphibian Campaign will also hand out special awards, and we would like to encourage participants from all over Europe to apply for these!



EAZA AMPHIBIAN CAMPAIGN

Amphibian Alarm - EAZA Year of the Frog Campaign 2007/8

EAZA launched its seventh conservation campaign during the 24th EAZA Annual Conference in Warsaw, Poland. Don Church of Conservation International and the IUCN Amphibian Specialist Group introduced the amphibian extinction crisis during the opening session of the conference on 12 September 2007. Later that same day, 'Amphibian Alarm, EAZA Year of the Frog Campaign 2007/8' was officially launched with a presentation by the chair of the campaign planning group, Quentin Bloxam. This was followed by a presentation by Andras Krolopp, deputy head of Countdown 2010, linking the amphibian campaign to the Countdown 2010 initiative (halt the loss of biodiversity by the year 2010). Finally, EAZA chair Bert de Boer emphasized the need for the amphibian campaign and urged all EAZA member institutions to join this very important effort.

Campaign targets

- Generate public awareness and understanding about the amphibian extinction crisis.
- Raise funds for implementing the *ex situ* aspects of the Amphibian Conservation Action Plan (ACAP).
- Encourage further EAZA member participation in amphibian *ex situ* conservation.
- Raise awareness and funds to support and supplement the activities of the EAZA Amphibian Ark (AArk).
- Further position IUCN and the zoo community as leaders in global conservation.

Specific goals for the EAZA Year of the Frog Campaign:

- A 100% EAZA member involvement.
- A fundraising target of €750,000.

Due to the urgency and the call for help by the global conservation community, it is EAZA's aim to have all EAZA members join this initiative and contribute to saving the planet's amphibians. So please sign up for this extremely important campaign!



amphibian ark
2008 YEAR OF THE FROG



EAZA Amphibian Conservation Fund

Previous EAZA Conservation Campaigns aimed to raise funds mostly for *in situ* conservation projects. The EAZA Year of the Frog Campaign is different because only a few *in situ* conservation projects for amphibians exist and the activities within Europe are mostly focused on *ex situ* breeding programmes. It was thus decided not to raise funds for specific projects but rather for an 'EAZA Amphibian Conservation Fund' that can finance future projects that are being developed. The Amphibian Conservation Fund will mainly focus on *ex situ* projects as these have been identified as the most efficient way to save amphibian species from direct extinction in the current situation. However, this does not exclude the possibility to use the fund to support *in situ* projects when feasible.

Projects will be selected for funding in accordance with the global and regional priorities. Global priorities will be defined by the global AArk, based on IUCN priorities. The priorities within Europe will be defined by the EAZA AArk and will of course be in support of the global priorities. An EAZA Amphibian Conservation Fund steering group will make a selection based on project applications and on Amphibian Ark proposals.

Campaign Info Pack

As always a Campaign Info Pack is available for all EAZA members to help organise the campaign within their institution. Those EAZA members that have not received their Campaign Info Pack in Warsaw will receive a copy by ordinary mail. Please use the registration form that is included in the info pack (or download it from the EAZA website) to join the campaign. Help support the global efforts to save amphibians!

WHO IS WHO IN THIS CAMPAIGN?

AArk

www.amphibianark.org

The Amphibian Ark (AArk) is a joint effort of three partners: the World Association of Zoos and Aquariums (WAZA), the IUCN/SSC Conservation Breeding Specialist Group (CBSG), and the IUCN/SSC Amphibian Specialist Group (ASG). The AArk was formed to address the *ex situ* components of the Amphibian Conservation Action Plan (ACAP). AArk organised '2008 Year of the Frog', the world-wide campaign focusing on generating public awareness and understanding of the amphibian extinction crisis and on raising funds to

support the AArk activities (www.amphibianark.org/yearofthefrog.htm).

EAZA AArk

www.eaza.net/conservation/conservation.html

The EAZA Amphibian Ark Working Group (EAZA AArk) was formed by EAZA to coordinate all AArk activities (focussing on *ex situ* breeding) within EAZA and its member institutions.

GAA

www.globalamphibians.org

The Global Amphibian Assessment (GAA) is the

first-ever comprehensive assessment of the conservation status of the world's 5,918 known species of frogs, toads, salamanders and caecilians.

ACAP

www.amphibians.org/newsletter/ACAP.pdf

The Amphibian Conservation Action Plan (ACAP) is an ambitious programme to combat the extinction of amphibian species, which resulted from the IUCN/SSC Amphibian Conservation Summit in Atlanta in 2005. This action plan requires the international community to enter uncharted territory and to take great risks.

INTRODUCTION

There is a lot zoos can learn from aquariums

Ever since the early 20th century, long before zoos started building eco-displays, most aquariums had already built and maintained contextualised exhibits, grouping together species from a similar geographical and ecological origin. As a result, modern aquariums are still ahead of zoos when it comes to interpreting habitats and creating awareness about our impact on the aquatic environment.

There are of course important differences however. Throughout the history of aquarium keeping, technological developments (both in life support systems and in glass and acrylic construction) have often determined which species could be displayed, how long they could be maintained and whether they could be bred. Many aquariums can still acquire a significant part of their livestock from the wild, thus the need for common and coordinated breeding programmes has not been as urgent as in the zoo world.

In April 2006, a new Memorandum of Understanding (MoU) was signed between EAZA and the European Union of Aquarium Curators (EUAC). As the organisation representing most collection managers in European aquariums, EUAC is uniquely placed to represent and coordinate the specific animal management and technical aspects of the aquarium world in Europe.

Originally, EAZA was also an organisation which focused primarily or solely on animal collection management issues, such as running the EEPs and ESBs. In recent years, however, EAZA has widened its mandate to include many other aspects of the running of zoos and aquariums. It now also works in fields such as education and visitor interpretation (including evaluation and visitor studies), marketing and PR, legislation, EU lobbying and EU funding, ethics and sustainability and in future EAZA will increasingly focus on the business aspects of running a zoo or aquarium. As many European aquariums are also professionalising these other important operational aspects, EAZA membership will undoubtedly become an interesting option for them to consider. Currently, about 40% of the EAZA member zoos already feature an aquarium facility or a series of aquatic exhibits on their sites. Although only approximately 7% of the other EAZA members are stand alone aquariums, we are quite confident that this percentage will increase in the future.

Marine and freshwater habitats are not just of crucial importance to biodiversity and environmental quality of life on Earth – they are simply essential to our global survival. The challenges ahead of us are enormous, but as Europe's zoos and aquariums we are uniquely placed to work together in making many millions of European citizens aware of what we can all do to contribute to this survival.

Of course this will also mean that EAZA will have to adapt some of its working procedures, rules and practical approaches – and that we will have to think 'zoos and aquariums' wherever we previously said or thought only 'zoos'. The EAZA/EUAC MoU was the first step, and with this special aquarium issue of EAZA News we now have practical proof that cooperation between these two organisations is both feasible and highly motivating.

On behalf of the editorial board and with many thanks to Heather Koldewey (chair EAZA Fish and Aquatic Invertebrate TAG) and Jürgen Lange (chair EAZA Aquarium Committee) for their enthusiastic assistance in producing this special EAZA News issue. •

Harry Schram

EAZA EXECUTIVE DIRECTOR





The EUAC and nature conservation

Paul Vanden Sande, European Union of Aquarium Curators, Belgium

The European Union of Aquarium Curators (EUAC) is a professional organisation for aquarium curators, aiming to actively promote professional improvement between specialists in the public aquarium field (please also refer to the back cover of this issue). In 2003 the general assembly endorsed a proposal to allocate a budget of €10,000 to financially support conservation projects submitted by EUAC members and to allocate the same budget yearly. This budget depends however on the financial situation of EUAC and can be revised every year. During the EUAC Committee meeting in 2006 it was decided that the maximum financial support to an approved project will be limited to 50% of the total estimated project cost.

So far, the following projects have been or are being supported by EUAC:

2004

- Establishment of a sea turtle rescue center in Bagnoli
Aquarium of Stazione Zoologica Anton Dohrn, Naples (see page 11)

2005

- Rapid assessment of the Corfu killifish (*Valencia letourneuxi*)
London Zoo Aquarium

Aims:

- 1) To establish contact with relevant in-country agencies and individuals who have knowledge of the species occurrence.
- 2) To survey known and suspected habitats of the species (assessment of habitat quality, introduced species, pollution, development, wetland drainage).

Some achievements of preliminary field survey:

- Partnership with the Hellenic Centre of Marine Resources, Institute of Inland Waters.
- The most comprehensive survey of *Valencia letourneuxi* throughout most of its range.
- An assessment of the conservation threats and recommendations on the species' conservation.

- Conservation of marines turtles at the Benin coast
Nature Tropicale Bénin and Wildlife Conservation Society, New York

Aims:

- 1) To preserve the current sea turtle populations along the coast.
- 2) To have 'ecoguards' propagate biological information and conservation techniques and to educate the local community.
- 3) To rescue adult turtles, protect nesting sites and artificially incubate eggs and release the young into the wild.

Actions undertaken:

- Beach surveillance to protect egg-laying turtles
- Celebration of Turtle Day on 8 January 2006 and exhibitions during traditional and religious celebrations.
- Training sessions for rangers and volunteers and information campaigns for public and tourists.
- Rehabilitation and release of rescued turtles.
- Incubation of eggs and release of young turtles at the Benin coast.

2006

- Sustainability of seahorses in the aquarium trade
London Zoo Aquarium (see page 12-13)

- Development of settlement tiles for coral breeding as part of the SECORE Project
Rotterdam Zoo Aquarium (see page 40)

- Three approaches on how to enforce nature conservation measures in the Phong Nha-Ke Bang National Park (Vietnam)
Cologne Zoo Aquarium

Aims:

- 1) To learn about the ecology and habitat requirements of some recently discovered lizard species
- 2) To focus on tadpole-frog relations and tadpole communities
- 3) To create educational tools to communicate the project goals to local people, rangers and the public.

2007

- Publication of the proceedings of the International Congress of Coral Husbandry

- Awareness campaign S.O.S by-catch (sea turtles, seabirds, marine mammals, sharks) 'You can save them'
Aquarium de Gijón

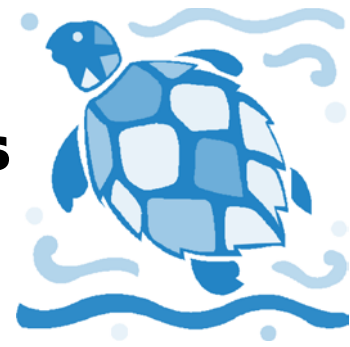
- Research on artificial induction of gonadal maturation of the European eel (*Anguilla anguilla*)
Aquarium Pula

- Conservation of marines turtles at the Benin coast
Nature Tropicale Bénin and Wildlife Conservation Society, New York (also supported in 2005)

- Habitat and population assessment of the Corfu killifish (*Valencia letourneuxi*) in Albania
London Zoo Aquarium (also supported in 2005) •

Committing to the conservation of marine turtles

Flegra Bentivegna, Stazione Zoologica Anton Dohrn, Naples, Italy



The Naples Aquarium is the last remaining example of a 19th century aquarium in the world. The institution opened to the public in 1874 as an integral part of the Stazione Zoologica di Napoli (SZN), a public research institute specialised in the field of marine biology. Since then, the aquarium has always had a strong scientific background, specialising in both common and rare marine vertebrates and invertebrates from the Mediterranean. During recent years the main aim of the aquarium has been the conservation of marine turtles.

A nation-wide rescue programme

The rescue programme for marine turtles started in 1983, following a growing international concern about the decline of marine turtles and their inclusion in the conservation plans of several conventions banning all hunting, transport and detention of these animals (Barcelona Convention 1976, Bonn Convention 1979, Bern Convention 1982). Through this nation-wide programme, wounded marine turtles (e.g. victims of sea traffic, pollution and indiscriminate fishing) were treated and rehabilitated with the aim of releasing them again and thus increasing their chances to reproduce and contribute to the continuation of the population (Bentivegna *et al.*, 1993; Bentivegna & Paglialonga, 1997; Bentivegna, 1997).

For this purpose, the SZN Rescue Centre was created, in addition to the already existing facilities of the Naples Aquarium. Here, rescued turtles are treated by veterinarians and rigorous maintenance and husbandry protocols are followed with respect to the turtles' biology and physiology. Rescued turtles either have incurred wounds, mainly caused by fishing gear or boats, or are extremely debilitated and undernourished due to ingested foreign bodies or unfavourable environmental conditions (Bentivegna *et al.*, 1993; 2002).

Particular attention is given to the phases of turtle rehabilitation during which the animals are held under constant observation to check their swimming ability, to handle bouts of apnoea, to control buoyancy and to monitor blood parameters and bodyweight. General studies on the turtles' biology and physiology are conducted at the same time (Bentivegna, 2002; Hochscheid *et al.*, 2004; Maffucci *et al.*, 2005). These studies mainly focus on the loggerhead turtle (*Caretta caretta*), which is the most common species in Italian waters.

The Turtle Point

The number of rescued turtles has increased exponentially in recent years, due to increasing numbers of external collaborators, the growing awareness of the local public, the support of many local authorities and the rising impact of human activity at sea. Consequently, available tank space became limited. Thanks to the continued support to turtle research and rehabilitation work from national and local politicians, as well as

from Bagnolifutura (the Neapolitan society of city transformation) and the European Union of Aquarium Curators, an area of approximately 600 m² was designated as the location for a new rescue facility in Bagnoli, Naples (Bentivegna, 2004).

'Turtle Point' opened on 13 September 2004. It includes 23 rectangular rehabilitation tanks (2 x 2 x 0.6 m), two circular rehabilitation tanks (3 m in diameter), a laboratory equipped to observe the animals, a kitchen for food preparation, an office and a conference room (approximately 60 m²). Sterilisation and filtration systems have been installed outside the building. The rehabilitation tanks are supplied with seawater through a closed circuit system. The water, taken from the Gulf of Naples and transported by truck to the storage tanks, is purified by filters and a UV system. The temperature (18 - 24°C) is regulated by a thermal exchanger.

Over 500 turtles rescued and released

More than 500 healthy sea turtles have been released back into the wild since the rehabilitation work by Naples Aquarium began. As recommended by IUCN (1988), some animals are being tracked via satellite transmitters after their release, in order to ensure their successful reintroduction and to verify their survival in the wild (Bentivegna, 2002; Bentivegna *et al.*, 2007).

Because of its well-documented activities, the SZN Rescue Centre and Turtle Point have become a reference for the whole Mediterranean. The United Nations Environment Programme – Regional Activity Centre for Specially Protected Areas (UNEP RAC-SPA) requested the Naples Aquarium to compose the 'Guidelines to improve the involvement of Marine Rescue Centres' (RAC/SPA 2004). •

PHOTO FLEGRA BENTIVEGNA



Project Seahorse; saving seahorses means saving the seas

Heather Koldewey, Zoological Society of London, United Kingdom

Seahorses are charismatic, fascinating and engaging. Their quirky features attract interest and make them one of the most iconic of fishes. Their reproductive strategy – including pair bonding and male pregnancy – is extraordinary in the animal kingdom. Most importantly, seahorses are representative of global threats to marine life: overfishing, bycatch (non-target fisheries) and habitat degradation and loss. So, saving seahorses can mean saving the seas.

Project Seahorse has just celebrated its 10th birthday. This project began as a small research programme working on species identification, which resulted in the publication of the first seahorse identification guide (Lourie *et al.*, 1999). Since then, many outputs, measurable outcomes and real impact have been achieved through building an international team and extensive collaborations with stakeholders and partners.

Trade management

Seahorses are used for traditional medicine, live aquarium fishes and as souvenirs and curiosities. Project Seahorse produced the first analysis on seahorse trade and consumption. This showed that the annual international trade has grown from twenty million seahorses traded by thirty countries in 1996 (Vincent, 1996) to over thirty million seahorses being traded by up to eighty countries at present. These findings led to new management regulations in entities as diverse as Australia, Hong Kong, and the European Union.

A landmark agreement among 169 nations to regulate international trade in seahorses for sustainability (CITES) was mentored in 2004. This was the first such decision for marine fishes of commercial importance and a breakthrough in global fisheries regulations. Unusually, the traditional Chinese medicine traders have also been actively engaged in trade management.

PHOTO PROJECT SEAHORSE



Seahorse popup PHOTO KATHLINA ALFORD



Working *in situ* in the Philippines

The Philippines is one of the main exporters of seahorses, and fishers there have to feed their families, only earning about €900 per year. Since its beginning, Project Seahorse has worked together with the seahorse fishing communities in a previously rich double-barrier reef in the central Philippines. This reef has been heavily depleted by over-fishing and destructive fishing methods. Fishers were aware of the problems, but felt powerless to make changes.

The project started in one village and assisted in setting up one marine sanctuary where no fishing was allowed. Since then, a further 27 marine sanctuaries across the region have been set up, with three to four being added each year. To put this into context, there is currently only one no-take marine sanctuary in the United Kingdom. An eight year monitoring programme has shown that these sanctuaries work, improving the number, size and diversity of fish species. As fish swim outside the reserve, the fishing also improves, benefiting both people and the environment. To encourage the fishers to work together, Project Seahorse catalysed a fishers' alliance called KAMADA (Kapunongan sa mga Mananagat sa Danaon). Starting with fifty members, the alliance now consists of over 900 subsistence fishing families across the region. KAMADA encourages governments to enforce fishing laws, mobilises communities on conservation issues and implements and manages the marine sanctuaries.

The project has also involved 33 young Filipinos through a high school scholarship programme. In exchange for funds to attend high school, the scholars worked as marine conservation apprentices during school holidays.

Seahorses in zoos and aquariums

On the other side of the world, seahorses are very popular within the public aquarium and the hobbyist communities, yet are difficult fishes to keep and breed and hundreds of thousands are traded every year. The first seahorse husbandry workshop was held in 1998, when seahorses were considered extremely challenging to maintain in a captive environment (Lunn *et al.*, 1999). From this initial collaboration and subsequent efforts, particularly by the European FAITAG and North American Marine Fish TAG, the life cycles of over ten species have now been repeatedly closed. These findings were compiled into a seahorse husbandry manual in 2002, which was updated in 2005 and now also includes information on the husbandry of the two species of seadragon (Koldewey, 2005).

Husbandry challenges

Surveys for the 2005 husbandry manual found that 17 species of seahorse were being held in 54 public aquariums. Of these, 16 were reported to show breeding activity, although only 11 of these are also being reared – defined as offspring reaching reproductive age. While it is recognised that some institutions may actively choose not to breed or rear their seahorses, it is important that these are active management decisions. Where breeding and rearing is not possible, further research must be carried out to improve the husbandry success with these species. Particular challenges remain with feeding and disease treatment.

Husbandry challenges also exist for the two species distributed throughout European waters, the short-snouted seahorse (*Hippocampus hippocampus*) and the long-snouted seahorse (*H. guttulatus*). There are few examples of successful rearing of these two species. None was reported in the 2005 survey, although breeding was reported in around 40-50% of the holding institutions. These are priority species for the European FAITAG, meaning the first goal of the programme for these two species is to successfully and repeatedly close the life cycle.

An online forum on all husbandry matters relating to seahorses and their conservation is available to zoo and aquarium professionals, as well as scientists, researchers, educators and other individuals. The list serve currently has nearly 200 members in 75 institutions in 22 countries.

Managing international trade

Aquariums can apply their knowledge of seahorse husbandry to improve the management of the international trade. London Zoo Aquarium has been working with HM Customs officials to accept any confiscated seahorses being illegally brought into the United Kingdom. After rehabilitation, seahorses have been distributed to other aquariums. Data are being recorded on survival rates (generally poor) and reproduction, as well as the initial details of the seizure. This helps CITES management authorities to enforce the legislation, as well as providing essential information to Project Seahorse about the effectiveness of CITES in managing the sustainability of the live trade.

Increasing the education level

With the continued improvements in husbandry success, more and

more aquariums are exhibiting seahorses. In addition to its unusual appearance, the seahorse's life history is also fascinating to visitors, with elaborate courtship, monogamous mating practices, and male pregnancy all making engaging stories. Basic educational messages may simply focus on species information, habitat, and distribution. Behavioural information may include descriptions of mating behaviour and reproduction as well as information on hunting, predation, and camouflage. More detailed educational messages may encompass habitat loss, over-fishing, traditional medicine, and other factors threatening wild seahorse populations.

As the popularity of seahorses increases, so must the level of the educational messages. Project Seahorse has provided technical support for the development of marine conservation exhibits for seahorses in public aquariums and it is estimated that these have reached ten million people each year.

PHOTO PROJECT SEAHORSE



Biological research

European aquariums have been involved with the research of a Project Seahorse PhD student to determine genetic variability and gene flow among populations of the two European species throughout their range by providing fin clip samples. This is the first study on the genetics of the two species, and will be complementary to the recently completed work of their life history (Curtis and Vincent, 2006).

Project Seahorse has become the recognised global authority on seahorses as measured by member roles as Chair of the CITES working group, IUCN Red List Authority, FishBase authority and as prolific authors of papers on seahorse biology, research and management. One of the team discovered a new species of pygmy seahorse *Hippocampus denise* in 2003 (Lourie and Randall, 2003).

In 2004, the most comprehensive review of seahorse life history and ecology was published (Foster and Vincent, 2004). This paper made recommendations for research on seahorses that is urgently required for conservation and management. Zoos and aquariums can undoubtedly help meet some of these research priorities.

For more information on Project Seahorse and for husbandry guidelines, please visit www.projectseahorse.org. •

Conservation of the endangered vendace in the United Kingdom

Jen Nightingale, BIAZA Aquarium Focus Group - Vendace Working Group, Bristol Zoo Gardens, United Kingdom

The current BIAZA Working Group for vendace (*Coregonus albula*), the most endangered freshwater fish species in the United Kingdom, was initiated by Bristol Zoo Gardens in 2003. The zoo formed a partnership with the Centre of Ecology and Hydrology assisting with the Biodiversity Action Plan for vendace. There are four main threats to vendace: the introduction of non-indigenous fish species, habitat loss, pollution (particularly eutrophication resulting from nutrient enrichment) and siltation of spawning sites with organic matter.

Life history

The vendace is a Salmonid (sub family coregonidae). It is a temperate white fish species, freshwater in the United Kingdom (UK) and anadromous (living in the sea mostly, breeding in fresh water) in Russia. Vendace occurs in north-west Europe between the English Lake District in the east to western Russia, and from northern Scandinavia to north-west Russia, reaching south to Bavaria. It is widespread and farmed as a food fish in mainland Europe, however it is thought that this may be a different subspecies than the UK vendace.

Vendace are planktonic feeders, occurring in open water shoals in deep, cold lakes where the species can take refuge from hot summer temperatures. Spawning occurs in November and December; adults move to the lake edges and the females scatter eggs in gravel beds in the still water. The eggs are fertilised externally and develop slowly on the bottom of the lake. They hatch the following spring. Vendace usually breed at two years of age, and usually live to about six years of age. They grow to a maximum length of 12 cm.

Current status

Historically (in 1966), vendace were common in Derwent Water and Bassenthwaite Lake in Cumbria, England and in Castle Loch and Mill Loch, in Scotland. Currently (in 2007), the vendace population in Bassenthwaite is declining or is even extinct, and it is extinct in Castle Loch and Mill Loch. The Derwent Water population appears to be stable. There have been several attempts in the last decade to introduce vendace, one of which was successful; the establishment of a vendace population in Loch Skene, Scotland in the 1990s.

The vendace is listed as 'Data Deficient' in the IUCN Red Data List and is fully protected under schedule 5 of the Wildlife and Countryside Act (1981). It is a priority species under the UK Biodiversity Action Plan, aiming to maintain the current populations and reintroduce and introduce the species to other sites.

Conservation actions

In line with the action plan for 2005/6 the aim was to obtain 100,000 vendace eggs from Derwent Water and to introduce these to Daar Reservoir (Scotland) and to identify safe refuge sites and brood stock holding sites

Bassenthwaite Lake PHOTO JEN NIGHTINGALE



within tarns in the Lake District. Any surplus eggs would be donated to public aquariums for public display and research (English Nature and Environment Agency approved). Unfortunately, the attempt to strip the adult vendace at Derwent Water failed.

In November 2006 vendace sampling for genetic research occurred at Loch Skene in Aberdeenshire, Scotland. Loch Skene holds a refuge population of vendace from Bassenthwaite Lake. This population is believed to be genetically distinct from the Derwent Water population and is very important due to the fact that the vendace within Bassenthwaite are either extinct or in very severe decline. Several thousand eggs were obtained during this sampling and were transported to a hatchery at Barony College in Dumfries, Scotland.

Short-term and long-term goals

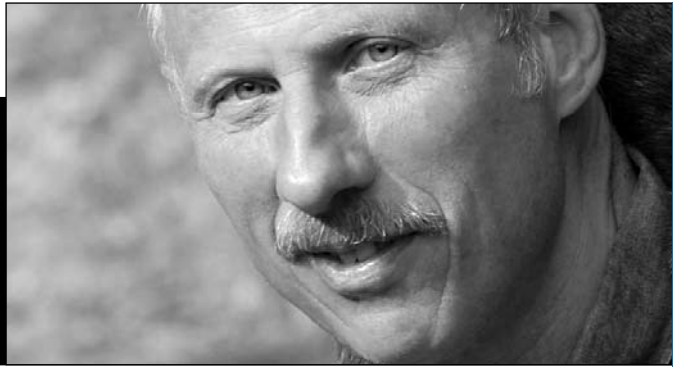
Following discussions between the project coordinators and the Scottish Natural Heritage, 150 of these eggs were donated to the Vendace Working Group. These eggs were transferred to the Aquarium of the Lakes in Cumbria, where they have hatched. Provided the rearing process (according to agreed husbandry methods) is successful, fish will also be transferred to other participating aquariums, for display with associated standardised interpretation. Furthermore, research projects will be undertaken with the fry, including food trials, and all data gathered will be compiled and disseminated.

The long-term biodiversity action plan focuses on cleaning up Bassenthwaite Lake and restoring the native vendace population. This action plan may well include further involvement from the Vendace Working Group. ●



Wolfgang Walter Gettmann

Position Director of Aquazoo Düsseldorf **Other zoo world activities** EAZA Council member (1998-2006), WAZA Membership Committee member (since 2006), screener of several European zoos for EAZA membership **Last book read** 'Bad Medicine' by Ron Querry **Favourite colour** Yellow, like sunflowers **Last trip made abroad** With my kayak to the Ardèche Valley, South of France



INTERVIEW

What do you like doing in your spare time? Biking, table tennis, swimming and canoeing. Furthermore, I play the violin (second violin, last desk) in the 'Orchester der Landesregierung Düsseldorf'. Sometimes I bring both music and profession together; travelling in China with the orchestra last year, I organised a visit to the Shanghai Aquarium and for the jubilee '130 years zoo in Düsseldorf' we produced a CD with the 'Carnival of the animals' from Camille Saint-Saëns.

Please describe your career path. I grew up in the centre of Saarbrücken and early on had decided that I wanted to become a zoologist. This was because I befriended a tree frog during my holiday in Bavaria and also because of my aunt's love for nature. Although I became intensely interested in genetics during my university years in Saarbrücken and Bochum, my wish to become a zoologist never wavered. In 1977, at the then newly founded university of Kaiserslautern, I did my doctorate on water-bound spiders and insects, a subject that had always fascinated me.

In 1978, I started as a zoologist at the Landesmuseum in Hessen, which closely cooperated with the zoo in Darmstadt. Between 1980 and 1994, I was managing director of the Pfalzmuseum for Natural History in Bad Dürkheim, where I introduced exhibitions on living indigenous animals. In 1992, I took over the development of the information centre in Biosphere Park Bou-Hedma in Tunisia. This facility specialises in the protection of native flora and fauna and explaining the reintroduction of wild animals from European zoos. In August 1994, I became managing director of the Aquazoo Düsseldorf, an institute based on the traditional zoological garden founded in 1876 and later unified with the Museum of Natural History.

What is the most memorable or fascinating event in your career so far? In 1996 I invited the world famous pioneer of underwater research and expedition leader, Prof. Dr. Hans Hass from Vienna, to our zoo. His maritime research reports have always fascinated me and it was because of him that I took up scuba-diving. The contact flourished and Hans Hass donated a large part of his valuable diving and photo equipment to be exhibited in our institute.

What do you enjoy most about your job? I particularly appreciate the fact that I can act as an interpreter between wildlife in its habitat and the very varied zoo public, thereby offering the people a window to nature.

What makes the difference between Aquazoo Düsseldorf and other aquaria? The Aquazoo Düsseldorf demonstrates evolution by displaying animals and their habitats. Due to unification of the two institutes – the traditional zoo and the natural history museum – it is possible to realise a complete synthesis of presentations, documentations and research.

What is your favourite aquatic species and why? I am especially fascinated by corals. They have helped to form our planet and are very important to our ecosystems. Corals are wonderful and successful models of evolution and act as bio indicators; if the coral reefs are healthy, then 'all is well' on Earth too.

How do you see aquariums evolving in the future? Only if mankind realises the importance of our marine system, we can hope that the treasures of the oceans are valued and protected now and in the future. Here, the significance of aquariums is expanding. The forerunners on this matter are the institutes committed to breeding and research and they are in the position to make specialised exhibitions to create public awareness on different subjects.

"Corals are wonderful and successful models of evolution and act as bio indicators; if the coral reefs are healthy, then 'all is well' on Earth too."

Aquariums focus more on species, groups and communities than on individual animal specimens. Do you see this as an advantage or as a handicap? Will there ever be a 'Knut' with fins and scales?

By displaying a great taxonomical variety of animals in aquariums – from protozoa to aquatic mammals – it makes it much easier to explain the 'web of life' to the general public. We do use an ambassador for Aquazoo Düsseldorf, namely the nationally well-known short-clawed otter 'Nemo' (named after a character from a book by Jules Verne). For example, Nemo is being used in lectures, to communicate a conservation message.

What is your expectation towards ZIMS and its use by aquariums?

In the near future, the ZIMS software will substitute our zoos' internal documentation. I am sure that it will be an excellent data system for our 450 different species. It will support our daily work with keeping, breeding and exchanging animals and I hope that the data in research fields can then be used more effectively.

What do you feel is the most important reason for aquariums to join EAZA? EAZA is both a forum and a mutual interests association for professional zoos and aquariums. It supports breeding programmes for endangered species, and offers help with managing zoo animal collections. EAZA mainly supports its members in fulfilling their four main tasks (which I may emphasise, are the same for zoos and aquariums): conservation, research, education and recreation. I would particularly like to express my appreciation for the close cooperation between EUAC and the EAZA. •

Aquarium collection management

Heather Koldewey, Zoological Society of London, United Kingdom

There are currently around 140 public aquariums in Europe reaching an audience of seventy million people a year. There is no standard definition for the term 'public aquarium' and there is incredible diversity in these organisations.

Public aquariums offer experiences that range from the more traditional 'art gallery' style of tanks to the total immersion of walking through a mixed species habitat or a tunnel. Tanks range in size from less than fifty litres to sixty million litres and species diversity is immense, encompassing mammals, birds, reptiles, amphibians as well as fish and invertebrates. Technological advances, particularly regarding life support systems and the use of acrylic, mean that aquariums can now exhibit fish with sensitive invertebrates and even plants in artificially reproduced but naturalistic settings, on a large scale.

Competing with nature films and internet

Historically, many aquariums focussed on freshwater species, perhaps due to their availability and the ability to breed and maintain many self-sustaining populations of these species. Most of the older aquariums still include large numbers of small tanks with a wide variety of species from both marine and freshwater habitats around the world. The trend in recent years has been towards smaller numbers of larger marine exhibits, perhaps because tanks can now be created on a scale that really relates to the experience of diving in the ocean. Public demand is also high, and we are competing with other visitor attractions as well as high quality nature films, the internet and computer games. Aquariums are responding to these demands through increasing in scale, diversity and also species. At the extreme, whale sharks are now exhibited in several aquariums in Japan, China and more recently in the USA. Most aquariums also now offer temporary exhibits that change on a regular basis. All of these pressures add to the curatorial challenges of collection management in aquariums.

Longevity

There are over 25,000 species of fish, representing considerable diversity. Some fish species live for less than a year, others for over hundred years. Some pupfish species we keep in aquariums are extinct in the wild and only live for about two years. Maintaining a healthy, demographically stable, breeding population in an aquarium requires active management over a relatively short timeframe. At the other extreme, the sawfish species currently kept in European aquariums (*Pristis zijsron*) will not reach sexual maturity for at least another five years, thus long-term planning is required to coordinate breeding efforts.

Reproductive strategies

Fishes exhibit oviparity, ovo-viviparity and true viviparity and an enormous

Species extinct in the wild (*Cyprinodon longidorsalis*)



variation in strategies of egg production (numbers), gestation time and the 'live bearing' or rearing of young. Fecundity ranges from single eggs in some sharks to several million in dispersal spawners such as cod and even up to 28 million in the ocean sunfish (*Mola mola*) (Reid and Hall, 2003). Sharks, the target of an enormous and overexploited global fishery, are often vulnerable because of slow sexual maturation, long gestation and low fecundity. Even highly fecund species, such as sturgeon, cod and lumpfish, are at risk from the commercial demand for eggs. Reproductive systems are still being elucidated for most fishes, with fascinating findings. Hormonal and pheromonal control varies considerably, and many species rely on cues such as changes in temperature, salinity, pH, day length, to initiate reproduction. These must be replicated in an aquarium environment to achieve successful breeding.

Colony management

Some taxa, such as Siamese fighting fish (*Betta splendens*), and seahorses (*Hippocampus* spp.), are sexually dimorphic. However, most species kept in aquariums have no well-marked external sexual differences. There is a genetic basis to sex determination with males producing sperm and females producing eggs, but hermaphrodites are known. Sequential hermaphroditism occurs in some wrasses (labrids), where all fish begin life as females with a single dominant male living within the 'harem'. When the male dies, a female changes sex to become the new dominant male. Clownfish (*Amphiprion* spp) females are produced from males by sex reversal.

These are just a few examples that indicate some of the complications of aquarium collection management. This has resulted in aquariums traditionally developing their own record keeping techniques, although a few use ARKS. The record keeping systems developed for many zoo animals have proved inappropriate for most aquarium species, e.g.





seahorses produce offspring in batches of a hundred to a thousand, on average every two weeks, which is beyond the capability and parameters of many small population management programmes. The development of ZIMS is eagerly anticipated to engage aquariums in a more standardised and universal approach to collection management.

Priorities for breeding programmes

Identifying priorities for *ex situ* breeding programmes relates, in part, to natural reproductive strategies: r-selection (high number of offspring with little or no parental care) and k-selection (low number of offspring and high parental care). For example, highly fecund species such as cod are inappropriate for *ex situ* conservation in an aquarium environment, though they can be cultured in larger coastal set-ups. Fecundity is not always the deciding factor for an aquarium-based programme, as the few offspring produced by a whale shark do not overcome the logistical and welfare challenges associated with keeping this species in captivity. Other species that are not currently held or bred in aquariums are of particularly high conservation importance and are worthy of review. For instance, the coelacanth (*Latimeria chalumnae*), with perhaps only a few hundred individuals left in a declining population (Forey, 1998), could be viewed as the aquatic equivalent of the Californian condor or giant panda. A major challenge is identifying those species deserving the highest priority for *ex situ* breeding and supporting these with effective, cooperative programmes that balance resources and talents, and are linked whenever possible to nature.

FAITAG

The first published paper in the International Zoo Yearbook on successful fish breeding in a public aquarium is by De Graaf (1969). Initially ineffective (Maitland & Evans, 1986), aquariums have since developed a role in conservation initiatives. The number of bony fish species bred for multiple generations in zoos and aquariums has increased from under fifty in 1962

to more than 350 in 1999 (per International Zoo Yearbook). A Fish and Aquatic Invertebrate TAG (FAITAG) database (Laterveer, 2005) on marine fish breeding found that over 700 marine fish species have been reproduced successfully in captivity, with nearly 300 species over multiple generations, as well as many invertebrates (e.g. anemones, jellyfish, tunicates, soft and hard corals). This greatly increased success in *ex situ* breeding is attributable, in part, to programmes being more closely related to species-specific needs for adequate space, water quality and diet for adults and growing offspring. Such basic knowledge is required for every unstudied species. The development of coordinated efforts, such as is occurring through the TAGs, will continue to speed progress.

Species targeted for collaborative research and breeding have been determined on the basis of threats in nature and suitability for maintenance and breeding *ex situ*. There are FAITAG programme management guidelines being developed: no small feat for species that vary so widely in life history and reproductive traits. The FAITAG approach to regional collection planning (RCP) was developed with the other lower vertebrate and invertebrate TAGs, and is based on a set of systematic criteria for species selection that meet conservation, education and research objectives. The development of a comprehensive RCP is still at a relatively early stage.

Linking *ex situ* and *in situ*

The ultimate challenge for fish conservationists is considering the linkage of *ex situ* breeding to sustainability of wild populations. To date, little effort has been directed at understanding the difficulties and feasibility of re-stocking endangered fish species to the wild with individuals or populations produced *ex situ*. A high strategic priority will be to systematically and comprehensively understand these challenges and develop model (test) programmes using guidelines of the IUCN Reintroduction Specialist Group (www.iucnsscrsg.org) and in-country protocols. •

This article has been abridged and the references were left out due to space limitations. For the original full version of the article including reference details, please refer to the 'Magazine' section of the EAZA website.

The seventh International Aquarium Congress (IAC)

will be hosted by the Shanghai Ocean Aquarium, China.

The theme for IAC 2008, 'Progress and conservation: the role of aquariums in protecting the aquatic environment' articulates a common mission of public aquariums.

For more information, please visit www.iac2008.cn



COLLECTION PLANNING

Coral husbandry symposium at Burgers' Zoo

Max Janse, Burgers' Zoo, Arnhem, The Netherlands



Nearly all public aquariums and many private aquariums display live corals. Because of the complexity of husbandry and the fast expansion of coral husbandry knowledge, the 'First International Symposium on Coral Husbandry in Public Aquariums and Zoological Parks' was organised. More than 140 aquarium specialists and scientists from 23 countries came together to discuss the latest news on coral husbandry.

This symposium, held in the new congress centre at Burgers' Zoo from 16 to 21 April 2007, was the third in a series of international symposiums within the public aquarium world. Previous symposiums were organised in 2001 in Orlando, USA (First International Symposium of Elasmobranch Husbandry in Public Aquaria) and in Lisbon, Portugal in 2004 (First International Symposium on Water Quality and Treatment in Zoos and Aquaria). The purpose of this third symposium was to bring together curators, aquarists, experts and scientists from around the globe to exchange information about corals in captivity in public aquaria and zoological parks. The idea was to provide a forum for presentations, discussion, peer review, and documentation of the most important aspects of coral husbandry, including the cutting edge of knowledge on the subjects.

Aquariums become larger

The two symposium keynote speakers discussed the link between the aquarium profession and the scientific world, which was an important point in the symposium. The introduction was provided by Bruce Carlson of the Georgia Aquarium (USA), who spoke about the history of coral husbandry and the link between captive and wild corals. Rolf Bak of the University of Amsterdam, presented his research on coral reefs in the Caribbean.

The first session of the symposium focused on the actual coral, with subjects including biology, nutrition, health and growth. Another session focused on exhibit design, which was followed by a session on large exhibits. There is clearly a trend in keeping corals in increasingly large, biotope aquariums. The largest coral reef aquarium in the world (2,500 m³) is the Reef HQ in Townsville, Australia. This open air aquarium receives natural sunlight and fresh seawater from a lagoon area. Sometimes the aquarium gets too much sunlight and has problems with the quality of the incoming natural seawater, while the 750 m³ coral reef tank at Burgers' Zoo depends on artificial seawater and artificial lighting with its own specific problems. These are just two examples of differences in coral management discussed. Several other challenges in keeping corals in aquaria with more than 100,000 l water were also presented.

LEDs may be the future

A logical step for the next session was to focus on system management.

What problems are encountered when keeping corals in closed systems, and how can these problems be solved? Specific overview talks were provided on filtration, nutrients and additions of calcium and trace elements. Other abiotic factors such as water movement and light were also presented. One specific talk of interest was on LED light, a type of solid state lighting (SSL) that utilises light-emitting diodes (LEDs) as a source of illumination. This type of light may be used for coral keeping in the future.

Coral culture and taxonomy

As the taxonomy of corals is complicated, a half-day workshop on coral taxonomy was provided to learn basic identification techniques and structures of coral names.

As the time when all corals originate from the wild is nearly history, fragmentation and nubbin techniques were described, as well as asexual culture and different experiences with captive sexual reproduction resulting from the SECORE project (please refer to page 40).

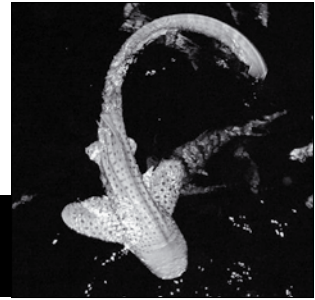
The presentation of Illiana Baums from the Pennsylvania State University (USA), on the use of molecular tools to differentiate among reproductive modes and to identify individuals and delineate populations in corals, resulted in a discussion about the feasibility of coral reef restoration. This discussion became even more extensive during the last session on coral conservation within the labyrinth, where different pilot studies on the feasibility of coral reef restoration were presented. Coral reef restoration may only be feasible when more information is available about regional declines and when the cause of a decline can be removed. •

PHOTOS BURGERS' ZOO



European breeding programme for the zebra shark

Max Janse, Burgers' Zoo, Arnhem, The Netherlands and David Gibson, the Deep Aquarium, Hull, United Kingdom



A European Studbook (ESB) for zebra sharks (*Stegostoma fasciatum*) was approved within the EAZA/EUAC Fish and Aquatic Invertebrate Taxon Advisory Group (FAITAG) in early 2007. This is the first official European breeding programme for a fish species.

Long-tailed bottom dwellers

The zebra shark is an attractive bottom-dwelling species. The dark brown juveniles have vertical yellow and white zebra-like stripes and the adults are brown and yellow with dark spots, similar to a leopard print. The sharks can grow as large as 2.5 m and are very docile. Due to their size these sharks are mostly kept in aquariums with a volume larger than 150,000 l. Zebra sharks often lay on the bottom of the aquarium, and their huge tail, which makes up one-third of the total body length, is most visible when they swim.

The IUCN categorises the zebra shark as 'Vulnerable' due to over-fishing. This shark is found in the Indo-Pacific, around Australia, in the Indian Ocean across to South Africa and in the Red Sea. The increasing number of large aquariums in Europe displaying this species has had a large impact on the natural populations because all animals in European aquariums originate from the wild.

The current captive population

The current population of zebra sharks within the European breeding programme consists of ten males and 12 females in 15 public European aquariums. Forty percent of the participating aquariums keeps two or more individuals, the others only keep one. Two additional aquariums have expressed an interest in participating in the programme. The origin of only one animal currently in the programme is unknown, and 16 individuals originate from the same geographical region; Cairns, north-east Australia. The fact that most of the animals originate from the same area is genetically favourable for a captive breeding programme.

Exchanging experiences

Zebra sharks are oviparous; they produce large eggs (8 x 19 cm), fixing them on coral with long, hair-like fibres. Only three females within the 15 European aquariums participating in the ESB have produced eggs. Burgers' Zoo in Arnhem was the only aquarium where a young actually hatched, but this died after six weeks without ever eating. Globally, at least six aquariums have successfully bred zebra sharks in captivity: Undersea World Aquarium, Cairns in Australia, Under Water World Guam, Omaha's Henry Doorly Zoo and Sea World San Diego in the United States of America, Okinawa Expo Aquarium in Japan and Ocean Park in Hong Kong. These successes indicate potential for zebra shark breeding in Europe, and information will be gathered from these institutions to

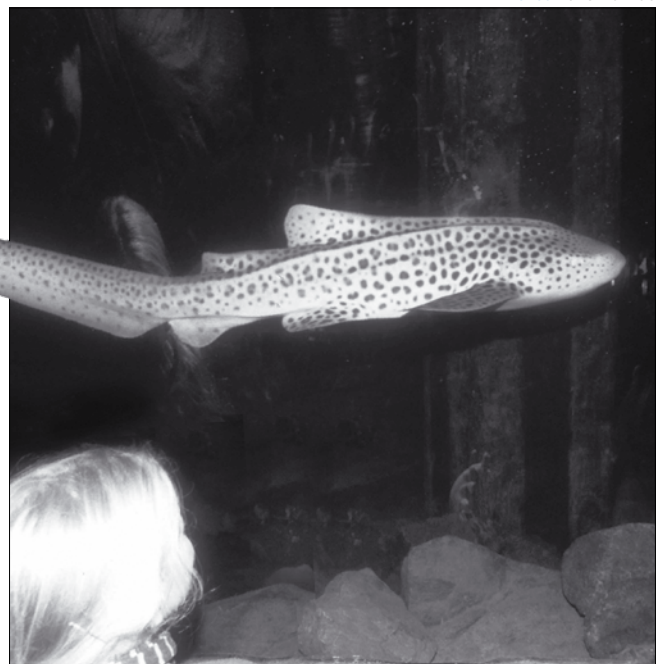
learn from their experiences. Furthermore, husbandry questionnaires have been sent to all aquariums participating in the ESB. The results of these questionnaires have been presented at the EUAC meeting in Salzburg, Austria (29 September to 3 October 2007).

A first step

Due to the potential of breeding zebra sharks in captivity and thus creating a sustainable captive population, it is felt that this European breeding programme can be an interesting first step towards setting up breeding programmes for fish. The first year's goal of the Zebra shark ESB is to create more pairs. The first new pair has already been formed at the Océanopolis in Brest. •

The Zebra shark ESB is managed by Max Janse (m.janse@burgerszoo.nl) and David Gibson (david.gibson@thedeep.co.uk). A second ESB has recently been approved for the Blue-spotted stingray (*Taeniura lymna*). This ESB will also be managed by David Gibson, together with Nuria Baylina from Océanario de Lisboa (nbaylina@oceanario.pt). Do not hesitate to contact the ESB keepers if you are interested in participating in one of these first ESBs for fish species.

PHOTOS BURGERS' ZOO



ZIMS; a quantum leap for the aquarium profession



Jaime Meyer, ISIS, Minnesota, United States of America

"Currently, we spend countless hours searching for data from our archives... often when time is a critical factor in providing the proper care needed by an animal. ZIMS will be designed to carry out these queries and comparisons of quality data within seconds, allowing husbandry and veterinary staff more time to implement a proper course of care."

Brent R. Whitaker, National Aquarium in Baltimore, USA

As ISIS has been developing ZIMS, the aquarium and zoo world's global animal conservation database, we have paid close attention to the needs of aquariums. When ZIMS becomes widely available in 2008, this web-based storehouse of information will allow aquariums to instantly access global data and work with one another collectively as never before. Undoubtedly, ZIMS will advance the aquarium profession and help create partnerships between aquariums, zoos, scientists, researchers, governmental agencies and environmental stewards around the world.

The many unique challenges aquariums have in managing their collections is well understood by ISIS staff. For example, an aquarium may acquire hundreds of specimens representing dozens of species during a single collection trip. Individual animals of the same species often cannot be distinguished and the specimens are held in large groups. This presents a challenge for entering information about these new acquisitions into the institutions' records. ISIS is creating specialised screens for ZIMS to make that process as easy as possible.

Watching water closely

No where in the world is water watched so closely and tested as often as inside aquariums, which must keep tight control over many environmental variables such as water quality, temperature, salinity and pH. Fields and pages are being constructed in ZIMS to easily record these

measurements as well as tank maintenance, life support system components and more. Aquarium staff can even receive automatic 'out of range' alerts if someone who records an environmental value is outside of a tank's established acceptable range.

Many departments within aquariums have software built specifically for their professional staff. However, ZIMS is one tool for all aquarium professionals: curators, veterinarians and aquarists. It will also be a resource for education, marketing, development and facilities departments. Overall, the goal of ZIMS is to offer aquarium and zoo professionals an opportunity to vastly advance the way they collect, store and disseminate data. Effective environmental stewardship requires leadership, dedication and the right tools. The lives of the animals in our care, and increasingly of entire species and ecosystems, depends on global collaboration, swift communication, and solid science. This is the vision underlying ZIMS.

Seven aquariums are involved

Fortunately, ISIS has several world-class aquarists as close advisors on the development of ZIMS. Additionally, Robert Boyajian, hired a year ago to lead the development of training material for ZIMS, has also worked as an aquarist. Included among the 21 ZIMS 'early adopter' institutions (the first institutions to use ZIMS) are many aquariums, of which two are in Europe: Bristol Zoo Gardens (United Kingdom) and Zoo Aquarium Berlin (Germany), and several are in the USA: Columbus Zoo and Aquarium, Disney's Animal Kingdom, The Living Seas, Monterey Bay Aquarium, North Carolina Aquarium, South Carolina Aquarium, Riverbanks Zoo and Aquarium and the Seattle Aquarium. •



PHOTO STOCKBYTE

"ZIMS is more than a collections management tool; it's a bottomless reservoir of experiences, results and knowledge that is readily available to the world with a click of the mouse."

Jason Crichton, South Carolina Aquarium, USA



Humans have been fascinated by the fauna living below the water surface since ancient times. This fascination is one of the main reasons for the current success of public aquariums. For most aquarium visitors the biodiversity of underwater fauna is an incredible wonder of nature.

In an effort to achieve the same success as aquarium exhibits, zoos have started to keep their aquatic animals in enclosures where underwater viewing is possible.

A large aquarium tank for hippos at Berlin Zoo

Jürgen Lange, chair EAZA Aquarium Committee, Berlin, Germany

Though it is very exciting to view the movements of hippos under water, it is no wonder that it took some time before zoos started exhibiting them in large tanks. As hippos immediately bespatter a new place of water to mark their territory and as their excrement contains a lot of undigested grass and leaves, the water immediately becomes dirty and green. The first zoos keeping pygmy hippos (*Hexaprotodon liberiensis*) and common hippos (*Hippopotamus amphibius*) behind glass were Singapore Zoo and Toledo Zoo respectively, and their exhibits served as an inspiration for the construction of the new 'Hippo House' at Berlin Zoo.

Hippo House

The Hippo House opened in 1997 after two years of construction, and offers a home to a group of common hippos, a pair of pygmy hippos, two groups of nyala antelopes (*Tragelaphus angasii*) and warthogs (*Phacochoerus africanus*). The house is partly built underground, to prevent it from appearing outsized. Two large glass domes are situated above the hippo enclosures; their 815 single glass panes cover an area of 1,200 m². As the open air enclosures for the hippos and nyala antelopes (560 m²) and the outdoor enclosures for the warthogs and pygmy hippos (each 250 m²) have been moulded onto the house, the visitors never realise the huge size of the building. The main attraction of the building are the large tanks for the two species of hippos. On the visitors' side, the pools are glazed with laminated glass (4 x 19 mm), several meters in length and 2.18 m high. The enclosures for the pygmy hippos measure 232 m² each and their pools contain 103 m³ water. The water is filtered with a turnover rate of 40 m³/h. The enclosure for the common hippos, with an indoor pool containing 550 m³ water, covers an area of 520 m². The pool is directly connected with the smaller outdoor pool through sliding doors, so during summer the hippos can swim in and out whenever they like.

Cleaning the pools

The island in the common hippo pool and the borders of the pool can be easily cleaned using a water cannon. The pool water is filtered with a turnover rate of 130 m³/h. High pressure water jets on the bottom of the pool pump up the mud so it floats through the skimmer to the filtration system. The mud and undigested grass are collected on curved and perforated



PHOTO BRÖSEKE

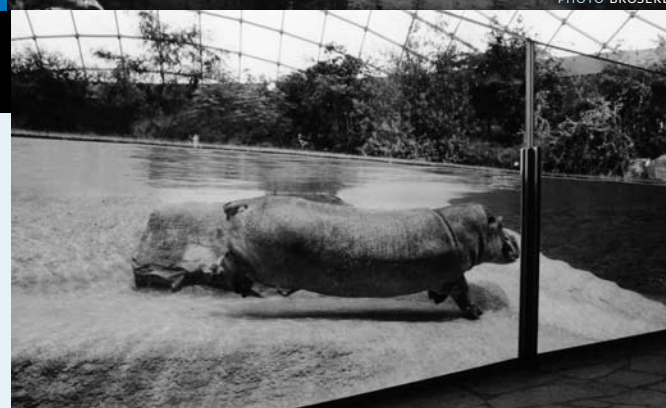


PHOTO GRIESBACH

steel strainers ('retro strainers') before the water passes through the filter towers. This prevents the material from clumping together and blocking the entire filtration system. The large particles slide down from the strainers and the water is pushed out, after which the particles fall down into the garbage lorry. Large swimming pool filter towers, filled with gravel (36,5 t) and activated charcoal (6,5 t) then filter the water. A large ozoniser sterilises the water. The filters' tap water mixed with air is used for backwashing. The backwash water is collected in a 50 m³ large storage tank to guarantee the necessary pressure for the backwash procedure.

'Green' aspects

Some ecological and money saving aspects were considered when constructing the Hippo House. The tropical vegetation used as decoration around the indoor pools is watered with rain water, which is collected in a 28 m³ tank. The water in the outdoor pools for the pygmy hippos is filtered through a 480 m² reed grass filter bed. The reed swamp also offers a natural surrounding for the outdoor enclosures and it filters around 60 m³ water per day. The flat roof of the building has been planted with bushes and other plants, which serve as insulation and are an attractive camouflage for the building. There are 42 solar panels (1.75 m² each) that produce the heat for the pygmy hippos' indoor pool. The large glass domes above the enclosures maximise the lighting inside the building, thus artificial illumination is only required during night receptions and on some extremely dark winter days. Meanwhile, Berlin Zoo's Hippo House has been a model for similar construction projects in other zoos and even today – ten years after the official opening – the Hippo House is one of the most important visitor attractions of the zoo. It is an adequate home for the breeding group of hippos, which has been living at the Berlin Zoo for more than fifty years. •

EXHIBIT DESIGN

Planet Penguin at Loro Parque

David Waugh and Matthias Reinschmidt, Loro Parque, Puerto de la Cruz, Tenerife, Spain

PHOTOS LORO PARQUE

The world's largest and most technically advanced penguinarium 'Planet Penguin' opened in 1998. This indoor penguin exhibit was built to enhance the overall positive experience for the park's visitors and to contribute to penguin conservation. The penguinarium houses penguins of some of the currently threatened species (out of the 17 existing penguin species, three species are listed by IUCN as 'Endangered', seven as 'Vulnerable' and two as 'Near Threatened') and Loro Parque participates in the Humboldt penguin EEP.

Four floors

The penguin complex consists of four floors, which are linked by the visitor route, a service lift and a staircase. The main floor is the exhibit floor. The upper floor includes the artificial and natural light systems, the ice machines and insulation. The two basement floors hold the air and water conditioning and filtration systems, three salt water tanks and the main freezers to store food (mainly fish). A corridor connects the basements with the hand-rearing and quarantine stations and the entrance for personnel, food and other supplies.

Sustainability

High insulation grade construction materials were used for the construction of Planet Penguin and wind power provides part of the energy that is used. Time switches are used with lighting and there are filtration protocols for maximum recycling of water and carbon traps for zero ozone emissions.

Visitors enter the penguinarium from a moving ramp, first encountering the Humboldt penguins (*Spheniscus humboldtii*). Visitors observe these penguins through a 15 m long glass wall, looking at the pool and the surrounding artificial rocks, which include artificial nest burrows. The light regime and temperature simulate that of the Canary Islands.

Through an ice-tunnel

Prior to entering the main exhibit area, visitors pass through an artificial ice-tunnel and are exposed to an Antarctic environment created by gusts of cold air and the sounds of penguin colonies. The main (Antarctic) exhibit displays king penguins (*Aptenodytes patagonicus*), rockhopper penguins (*Eudyptes chrysocome*), gentoo penguins (*Pygoscelis papua*) and chinstrap penguins (*Pygoscelis antarctica*).

This exhibit is elliptical, with a central land area divided by a 2 to 3 m high ridge of artificial rocks mostly covered in ice and snow. The land area is surrounded by water on all sides, except at one narrow end, which

provides hidden access to a food kitchen and two additional food stores.

The entire exhibit (65 m²) is mostly surrounded by glass panels that form the viewing area. These panels are made of two-layer safety glass (30 mm thick) designed to withstand a pressure of up to 1000 kg/m². Due to the temperature difference between the visitor area (20°C) and the interior of the main exhibit (air -3 to +3°C, water +10°C), a stream of cold air is injected from below and aspirated from above the glass panels to avoid condensation on the viewing windows. The photoperiod in the exhibit corresponds to the photoperiod encountered at 60° latitude south.

An eight-minute journey

The air in the exhibit is filtered and a continuous daily fall of 12 tonnes of ice flakes provides the penguins with fresh water. Visitors can use the moving walkway around the enclosure, which is a journey of eight minutes. The water level inside the exhibit is at breast height of a human adult, so visitors can observe the penguins both on land and in the water. An enclosure with a colony of Atlantic puffins (*Fratercula arctica*) leads to the exit of the main exhibit area. There, visitors descend to the basement floor via an acrylic aquarium cylinder of 4 m in diameter and 8.5 m high, showing marine fish (*Boops boops*). Prior to actually leaving the building, visitors pass by the lower portion of the Humboldt penguin exhibit, which shows the birds under the water surface.

Interpretation

The main interpretive signs are presented in three languages. Panels identify the species in the exhibit and include information on distribution, moult and development. Additional details are provided through inter-active touch-screens. Panoramic monitors on a viewing terrace show a twenty-minute film about the penguins' natural environment. Furthermore, large panels describe the impact of man on the southern oceans and its animal and mineral resources. •



PHOTO: LIVING COASTS

Tony Durkin, Living Coasts, Torquay, United Kingdom

Living Coasts; the challenges of a mixed exhibit

Living Coasts is a mixed marine coastal zoo with a range of avian and other animal species in an idyllic setting, perched on the cliffs on the edge of Torbay. The objective of Living Coasts is to give the visitor a new perspective on marine mammals and birds, in particular regarding their conservation and behaviours not easily seen in the wild.

Living Coasts opened in July 2003. The attraction is relatively small, with only 1.3 acres of outside space and a similarly sized indoor space. Five tanks run through the entire exhibit, all five of them using natural salt water. A sixth tank, the wader estuary, uses freshwater. The site has a water treatment system with filtration and a protein super skimmer to remove pollutants. The water is either recycled back through the system or is discharged as effluent after disinfection.

Free flying alcids

A meshed aviary includes two defined flying areas, one for alcids and one for other coastal birds, which also has underwater viewing of fur-seals, penguins and other species. Four species live in the alcid enclosure: common guillemots (*Uria aalge*), pigeon guillemots (*Cephus columba*), tufted puffins (*Fratercula cirrhata*) and red legged kittiwakes (*Rissa brevirostris*). Different areas of the exhibit are used by different species; the kittiwakes perch on the cliff top, while the others utilise the ground in front of the cliff. All species exhibit natural behaviour; the common guillemots flock and the pigeon guillemots disperse throughout the habitat.

A cliff constructed from artificial rockwork has holes specifically cut for the relevant species and a wave machine in the exhibit mimics appropriate water conditions. When feeding the birds, the technique is quite important; the food not only has to be provided in several sizes for the different bird species, but also in several ways, e.g. through regular scatter feeding, use of dishes and 'on the doorstep' feeding (at the nest site) during the breeding season.

Birds and mammals combined

The main exhibit includes four distinct habitats: a wader estuary, a penguin beach, a seal cove and a penguins' rookery. The estuary has six species of birds: pied avocets (*Recurvirostra avosetta*), black necked stilts (*Himantopus himantopus mexicanus*), redshanks (*Tringa totanus*), ruffs (*Philomachus pugnax*), common terns (*Sterna hirundo*) and Caspian terns (*Sterna caspia*). There is the potential for the avocets and the stilts to interbreed and compete for the same habitat. Stilts tend to dominate, therefore their numbers are kept low in comparison to the avocets and it is ensured there are enough breeding sites on the beach by managing the vegetation. Ruffs and redshanks occupy similar habitats, but the redshanks prefer a different area, and being a perching bird, occupy a different niche to the ruffs. As the Caspian terns are antisocial and tend to cause the waders to fly up, this has to be monitored by keeping records of incidents and result-

ing traumas. The Caspian terns have a clearly defined beach area which they defend. Potential conflicts are being mitigated by managing the species:species ratio (2 Caspian terns:47 avocets).

Initial problems

The first birds had problems when they were introduced to their new exhibit, as they were nervous. Furthermore, not being full-winged they were unable to cope with the large flying space. The South American fur seals (*Arctocephalus australis*) are very popular with visitors, but provide an additional dimension to exhibit management. Being carnivores, the seals presented problems when naïve birds inadvertently landed in their pool. There was also aggression among the different bird species; the avocets in particular were objects of aggression when they landed in other habitat exhibits. Other birds would peck and bully them, giving rise to trauma injuries. Capturing and displacing birds would however result in more problems due to traumas arising from hitting the net or the supports. Because of these problems a decision was taken to allow the feathers to grow on most species, thus improving their flying ability and reducing mortality.

Pool restriction

The sea duck pool has a wide range of species, including black scoters (*Melanitta nigra*), spectacled eiders (*Somateria fischeri*), common eiders (*Somateria mollissima*), barrow's goldeneye (*Bucephala islandica*) and long-tailed ducks (*Clangula hyemalis*). All the ducks are pinioned and therefore restricted to their pool. The eider ducks are low-level fast flyers which would be at significant risk if allowed to be full-winged. The species could interbreed, but age separation in the population is maintained by intermittently introducing sexed and similar aged species, this allows the same aged group of the same species to bond. This may have been a contributing factor in ensuring that to date there has been no interbreeding.

Penguins mingle with visitors

The penguins – Jackass penguins (*Spheniscus demersus*) and Macaroni penguins (*Eudyptes chrysolophus*) – can mingle with the visitors. This alternative 'mixed exhibit' provides significant interaction (penguin-penguin and penguin-human). There is the inevitable risk of visitors being pecked, but this has only been reported on two occasions in four years. A penguin patroller supervises the penguins (and the visitors) to ensure that encounters are a positive experience for all. •



European fresh-water species at Besançon

Mickaël Béjean, Benoît Quintard and Jean-Yves Robert, Muséum de Besançon, France



There is no need to show exotic species – although they are often more colourful – to explain the physiology of a fish or the structure of an aquatic ecosystem. People are often more receptive to the educational content of an exhibition when they are familiar with the species exhibited. It helps them to acquire knowledge about the biodiversity of their local environment and the fragility of aquatic biotopes. The goal of the Muséum de Besançon is to turn its visitors into active nature conservationists, focused initially on their local environment.

Since being founded in the 1950s in the Vauban Citadelle, Muséum de Besançon has tried to develop alternative, more attractive ways to explain nature rather than through classical exhibitions such as herbariums. Thus a small zoo was created in 1959 (and totally reconstructed between 1998 and 2004) and the first aquarium devoted entirely to European aquatic biotopes opened in 1975, with the scientific support of Besançon's University. While renovating the aquarium in 1995, the museum's curators decided to maintain and enhance this 'European spirit' and this was also the focus of the 'Noctarium' developed in 1997, which presents only local small mammals.

Besançon's aquarium characteristics

Besançon's aquarium consists of three areas. An indoor room is dedicated to running waters, with nine aquaria (2 - 24 m³) recreating the schematic profile of a typical European river. It is divided into three river zones and contains about forty different species of fish. Secondly, an outdoor aquatic garden presents stagnant waters associated with biotopes. Various artificial ponds show aquatic plants, amphibians and macro-invertebrates. Two of these ponds present invasive or domestic species that do not belong to the indigenous fauna. The first one is dedicated to Florida turtles

(mostly *Trachemys scripta*), donated by the public or found in nature. Muséum de Besançon is an official rescue and rehabilitation centre for this species (see www.esu.u-psud.fr/floride/). The second pond plays a far more playful role; it is a touch pool containing goldfish (*Carassius auratus*), koi carp (*Cyprinus carpio* spp.) and some varieties of common carp (*Cyprinus carpio*).

The third part of the aquarium includes a fish hatchery where visitors can learn about reproduction techniques. The hatchery was initially created for rainbow trout (*Oncorhynchus mykiss*) but has been redesigned for threatened local species.

"It is quite fascinating to work with a species living in a river just a few kilometres from the Citadelle..."

Local conservation

Muséum de Besançon exhibits many exotic species managed through an EEP or ESB (mainly primates). The aquarium tends to maintain this conservation approach, but with a focus on local fauna species which are also very threatened. Muséum de Besançon has been working on the artificial reproduction of noble crayfish (*Astacus astacus*) since 1998. This species has totally disappeared from French rivers, but as Muséum de Besançon produces 2,000 to 3,000 small crayfish annually, specimens can be released in order to establish sustainable populations and to restore the biodiversity of regional ponds. In addition to the existing breeding centre, since 2004 Besançon has been developing a more formal conservation breeding unit in support of the European LIFE programme, focusing on the conservation of the remaining populations of the Rhone streber (*Zingel asper*). There are less than 2,500 wild specimens of this small French endemic fish left in only a few rivers. The museum built a new experimental hatchery and an education room devoted to improving the captive breeding of this threatened species. Furthermore, the museum focuses on informing the visitors about this fish, its threats and the different conservation measures that are carried out as part of the LIFE programme (see www.aprondurhone.fr/). •

Astacus astacus PHOTOS MUSÉUM DE BESANÇON

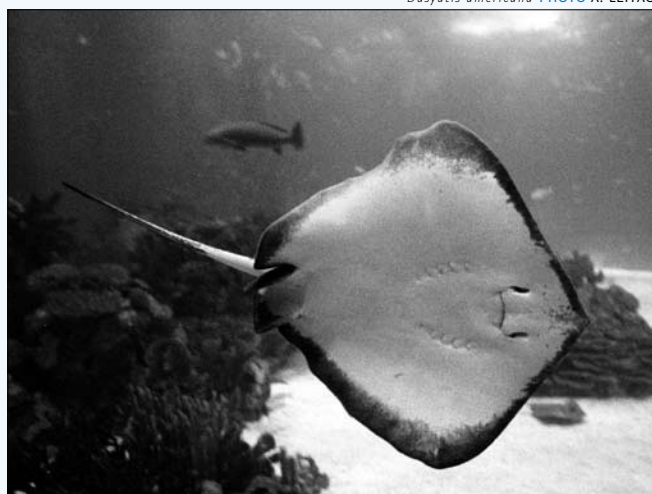


Lisboa-Ocea PORTUGALSOURCE
NÚRIA BAYLINA*Dasyatis americana* PHOTO A. LEITÃO

Two different ray species kept at Oceanário de Lisboa gave birth during 2006 and 2007. These ray species are kept in the 5,000,000 l main tank (water temperature 22°C) representing the Global Ocean. The tank holds 77 species of teleosts and elasmobranchs from different parts of the world. Due to the tank size and number of animals (approximately 3,000) it is not easy to keep track of all pregnant females.

In February 2006, one of the **common eagle rays** (*Myliobatis aquila*) that arrived at the institution in 2000 seemed pregnant and periodical ultrasound exams were initiated. The female gave birth to four rays during one of these ultrasound examinations. The offspring were transferred to a quarantine tank and the mother was returned to the main exhibit tank. Two of the young rays are still in the quarantine tank and the other two have been transported to the aquarium of Gijón in Spain, which currently keeps eight common eagle rays.

Oceanário de Lisboa has kept **southern stingrays** (*Dasyatis americana*) since 1998. Two new-borns were found in the bottom of the main tank in November 2006. There may have been more, but if so they were probably eaten by other fish in the tank. The two young rays were transferred to a quarantine tank. One is still there, while the other has been transported to the aquarium of Gijón in Spain.



On March 2007 a pregnant female southern stingray was moved to a quarantine tank to enable closer monitoring of her pregnancy. After two months four rays were born. Three of them are still being kept in quarantine, the fourth only survived for three days. It died due to a lesion caused by a piston in the tank. The mother was returned to the exhibit tank several days after giving birth. The young rays, weighing about 350 g at birth, are being measured and weighed regularly. Currently, Oceanário de Lisboa keeps five southern stingrays.

London UNITED KINGDOMSOURCE
RACHEL JONES

The **pink sea fan** (*Eunicella verrucosa*) is a temperate gorgonian which is at the northerly edge of its range in the United Kingdom. Damage to populations from trawling and dredging activities have resulted in legal protection for the species *in situ* and support for *ex situ* research projects into its biology. Populations are held in research systems at the Zoological Society of London (ZSL) and The Deep aquarium in Hull, under a grant provided by Natural England (www.naturalengland.org.uk).

Production of gametes from colonies in one group at ZSL was observed on 18 April 2007 and in the second group on the following day. Gametes were produced on consecutive days in both groups and a second round of spawning was observed in a few colonies the following week. An analysis of water temperatures showed that despite the presence of chillers on these systems, the temperatures did fluctuate and tracked changes in ambient air temperatures – this probably provided the cues the colonies needed to start spawning.

This is one of very few *ex situ* observations of this species reproducing, and the first concerted effort to settle out primary polyps. Observations will be made to see if there is any recruitment of primary polyps over the following months. The difficulty of obtaining and fertilising these tiny gametes in a re-circulating system is a hurdle to reproduction in many coral species – being able to predict spawning events in advance is key to developing successful collection techniques.

A programme involving controlled temperature increases is planned at The Deep aquarium in an attempt to stimulate spawning behaviour in the group there. Close observations will be made of any further reproductive activity once the increased temperatures have had a chance to have an effect on the colonies. These observations will hopefully increase the understanding of the reproductive biology of this species. It is encouraging that these colonies have remained healthy enough long-term to invest the energy required in reproduction. It is hoped to be able to plan ahead for the next spawning event.

Possible spermaries leaving polyps PHOTO ALEX CLIFFE/ZSL



BIRTHS AND HATCHINGS

Berlin GERMANY

SOURCE
RAINER KAISER

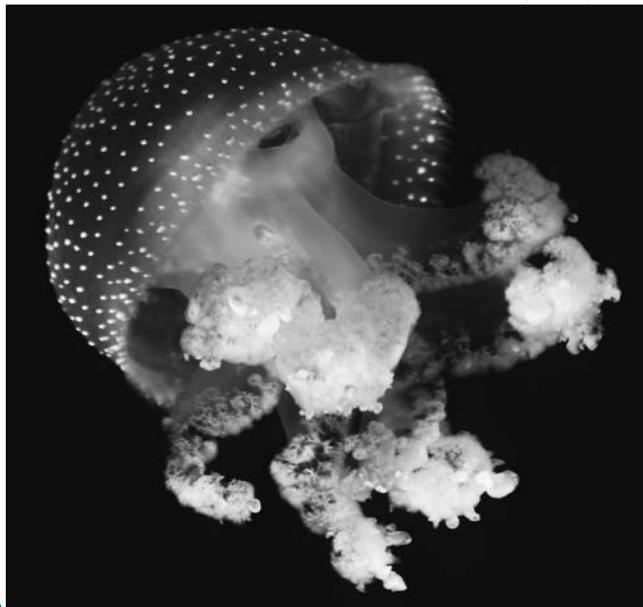
PHOTOS ZOO AQUARIUM BERLIN

Jellyfish have become a symbol or a trademark for the Zoo Aquarium Berlin. Today many people, including journalists, visit the aquarium especially because of the jellyfish. Currently, 16 species are kept as polyps for breeding purposes and six to seven species are permanently exhibited as medusa.

Breeding jellyfish (Scyphozoa) is quite different from breeding fish or higher vertebrates. This is not only because jellyfish can only be bred under laboratory conditions, but also because Scyphozoa have an asexual generation (polyps) and a sexual generation (medusa). Medusa can be male, female or bisexual, but in this case they usually are protogyn (females transform to males) or protandryn (males transform to females). Therefore autogamy (self-fertilisation) is not possible.

The medusa spawn in open water and after fertilisation of the eggs tiny free-swimming planula larvae hatch. They settle on a hard surface to develop into a polyp. This polyp can propagate and develop a net of polyps, or under special circumstances the polyp can strobilate by separation of its mouth and tentacles' disc, which forms the ephyra larvae. The ephyra will grow into a large medusa and then the whole reproduction cycle can start again.

The life-span of medusa in an aquarium is about one year. Therefore, if it is planned to exhibit jellyfish permanently, it is necessary to continuously supply new animals from the wild or to breed them regularly. Special conditions and water parameters must be simulated in the artificial habitat of the aquarium to induce strobilation: the polyp must be healthy and well fed and treated with a temperature shock, the percentage of iodine in the water must be raised and water movement encouraged. If these parameters are altered in the correct amounts – which differs from species to species – strobilation will start in two to three days. If strobilation does not then begin, the polyp must be kept under its original conditions again, and the whole procedure repeated two weeks later. Normally, strobilation will start then.

Phyllorhiza punctata

The tiny ephyra larvae have to be kept in smaller tanks and with gentle water movement, which keeps the larvae floating. If the current is too high or too low, the medusa will be deformed (bell shaped). This deformation also occurs when the ephyra or the young medusa are not well fed. Initial food usually is *Brachionus* sp. or other marine plankton, later (*Artemia* nauplii) can be fed.

Before the medusa have grown into a size that an air bubble can be caught under their umbrella, they must be shifted into a plankton kreisel tank or an aquarium with a similar water movement. The size and weight of the medusa are of course important in regulation of water current strength.

The medusa must have sufficient food continuously. The Rhizostomidae, and also the moon jellyfish (*Aurelia* species), can be fed with live *Artemia* nauplii, but some other species, e.g. *Phacellophora* sp. and *Chrysora* sp., should also be fed with larger shrimps, fish and even jellyfish. Food can be offered several times a day by hand, directly under the umbrella. Some jellyfish species such as the genera *Phyllorhiza* and *Cotylorhiza* have zooxanthellae in their umbrella and therefore require an intensive bluish light (20.000 K) for 10-11 hours a day.

If the husbandry guidelines and all the requirements are followed, not only can the strobilation of ephyra larvae be induced at all times, but also the ephyra will grow into nice, large medusa. Only then a permanent and fascinating jellyfish exhibit is guaranteed.



Chester UNITED KINGDOM

SOURCE
VICTORIA DENNICK

The **redline torpedo barb** (*Puntius denisonii*) was first described by Day in 1865, but it was not until over one hundred years later that the species was 'discovered' by the aquarium trade. This endemic Indian fish, with attractive black, red, green and yellow markings on a silver background, immediately became the latest 'must-have'. Fashions in fish keeping are nothing unusual; other highly prized species, past and present, include Malawi and Lake Victoria cichlids, the zebra catfish (*Hypancistrus zebra*) and the Celestial pearl danio (*Celestichthys margaritatus*). However, this popularity can have severe repercussions for wild populations, as the massive over-collection and habitat destruction surrounding the Celestial pearl danio can testify (Clarke, 2007, Practical Fishkeeping Magazine). Despite the pressures of collection for the ornamental fish industry, the redline torpedo barb is not currently included in the IUCN Red List. However, according to popular fish-keeping magazines, an environmental assessment in 1997 listed this species as endangered.

A shoal of thirty sub-adult redline torpedo barbs imported from Jakarta in Indonesia arrived at Chester Zoo aquarium in March 2005. The shoal was quarantined and then moved to a display tank in the zoo aquarium. It is unknown whether the fish were wild caught and trans-shipped from India to Indonesia, or captive bred in Indonesia using hormones to induce spawning, as hormones are used in species that are difficult to breed naturally. Fish reproduction is controlled by external environmental factors, (such as temperature, nutrition and weather cycles), which then trigger internal mechanisms. If the critical environmental triggers for a specific species are unknown, this stage of the spawning process can be by-passed by injecting hormones into the fish to directly kick-start the internal process and artificially induce a spawning.

In the Spring of 2006, a single fry was discovered in the display tank housing the adults at Chester Zoo. It had already grown to nearly 10 mm in length. This was quite a surprise, since no spawning behaviour had been observed in the group. The lone fry successfully grew and gradually integrating into the adult shoal.

Denisonii adult PHOTOS COLIN CRIST/CHESTER ZOO



Spawning behaviour was observed for the first time in February 2007, and the group continued to spawn on a regular basis for several weeks. The fish were spawning next to the filter, and regular siphoning of the filter chambers yielded fifty fry over a period of six weeks. No more fry were retrieved after this period and no more spawning behaviour was seen. The environmental parameters within the tank remain constant throughout the year, but this glass-topped tank is exposed to natural daylight as well as the artificial aquarium lighting. It could be suggested that changes in photoperiod may play a role in triggering spawning events.

The fry were initially raised on freshly hatched brine shrimp and finely crumbled flake, then moving on to a staple diet of flake, bloodworm, beef heart and lettuce. Forty of the fifty fry survived and after six months the juveniles are approximately 8 cm total length. The fry initially displayed black vertical banding but gradually started developing the full adult markings and colouration after approximately eight weeks.

Chester Zoo has yet to find any previous report of this species spawning naturally in captivity.

Denisonii juvenile



Enhancing a sustainable and responsible marine ornamental trade



Nathalie Gamain, Marine Aquarium Council, Hawaii, United States of America

Public aquariums and zoos are important stakeholders in ensuring that the marine ornamental trade is sustainable and responsible, as advocated by the Marine Aquarium Council (MAC). This council is dedicated “to conserve coral reefs and other marine ecosystems by creating standards and certification for those engaged in the collection and care of ornamental marine life from reef to aquarium”.

Trade concerns

Increasingly more aquariums encourage conservation and sustainable management of the marine environment and are concerned about the collection practices used to acquire marine animals for exhibition (e.g. use of destructive collection methods, poor handling and husbandry practices and unnecessary animal mortality).

Institutions are turning to MAC certification to demonstrate that best practices are used in their animal acquisitions. Some institutions' acquisition policies specifically require collaboration with MAC certified suppliers whenever possible: “Today, when our institution needs to populate its tanks with marine ornamental organisms, we prefer to contact MAC certified operators. This is part of our quality seeking strategy and support of a more responsible marine ornamental trade that we try to enhance at our aquarium”, says Nuria Baylina, curator at Océanario de Lisboa, Portugal.

Another European institution has even pushed further with its ethics and environmental concerns with its Fiji coral reef tank, populated solely with MAC certified and cultured species: “Our many visitors deserve a true and transparent approach to conservation and obtaining life forms from sustainable sources is essential.” says Kerwin Porter, aquarium curator at the Horniman Museum and Gardens in London, United Kingdom.

Self-sufficient aquariums

Some aquariums have been self-sufficient for many years with some of their species. For example, the Oceanographic Museum of Monaco started in 1989 with the presentation of in-house cultured corals. Several other institutions have been following along this path and are minimising their impact on the marine environment.

The aquarium breeding programmes represent a new supply for the industry, which sees the arrival of complementary species to the ones offered by fishermen: “We have started to successfully breed the royal gramma (*Gramma loreto*), which is very popular amongst industry operators and hobbyists. This species is very difficult to reproduce because of its delicateness, and it requires both strong competences and a high level

PHOTOS M. DAGNINO/OCEANOGRAPHIC MUSEUM OF MONACO



of technology. This activity is not productive enough for commercial entities to implement. It is our role as a safe guarder of the oceans to offer this complementary supply to the market.” adds Pierre Gilles, aquarium manager at the Oceanographic Museum of Monaco.

Support to MAC

For years the Fish and Aquarium Invertebrate TAG generally supported MAC, but without specific action or engagement. As stakeholders, aquariums need to influence MAC as a developing project and provide input.

ILLUSTRATIONS MARINE AQUARIUM COUNCIL

MAC Standards and Certification for the Entire 'Chain of Custody'

COLLECTORS AREAS



COLLECTORS



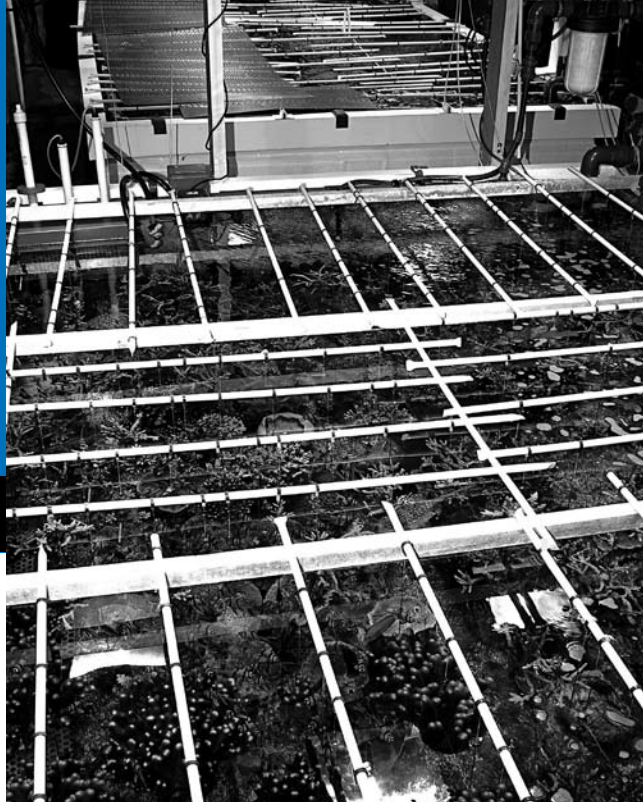
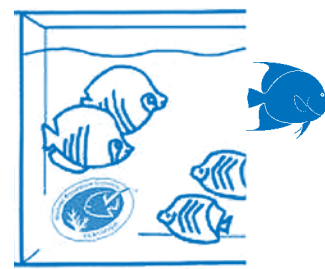
EXPORTERS-
BREEDERS-CULTURISTS



IMPORTERS



RETAILERS



Through the establishment of the EUAC MAC working group, aquariums were able to outline their concerns, which included:

1. Limitations in collection areas; a strategic decision of MAC to target certification in the most problematic areas of the trade (e.g. Philippines, Indonesia), which took time to improve enough to certify.
2. Problems with the supply of species useful for aquariums.
3. Non-certification of excellent individuals/organisations.
4. Poor consistency of shipment quality.
5. Challenges in promoting MAC to the public through aquariums when few retailers are MAC certified.

Aquariums now have regular meetings with MAC (e.g. at the EUAC Annual Conference), which has improved dialogue, helped make MAC work better for aquariums and has helped aquariums become more directly involved. Public aquariums are obviously tiny consumers compared to hobbyists, however, they are high profile and have the opportunity to influence and guide. As part of the trade and consumers of ornamental fish and invertebrates, they have a duty and responsibility to improve the trade where possible.

Interaction with visitors

Several institutions have started informing their visitors about MAC and its programme. On World Ocean Day on 8 June 2006, MAC launched its first informative exhibition at the Oceanographic Museum of Monaco. Such exhibitions help raise public awareness and hobbyists can become engaged with reef conservation issues, thereby making better informed choices about what they buy, e.g. by choosing MAC certified organisms from MAC certified suppliers.

For more information about the Marine Aquarium Council and the role your institution can play in supporting a sustainable and responsible marine ornamental trade, please visit www.aquariumcouncil.org.

SUSTAINABILITY

Sustainable acquisition in aquariums

Heather Koldewey and Brian Zimmerman, Zoological Society of London, United Kingdom

Aquariums are often considered different from zoos because of how the animals are acquired. The majority of mammals and a large proportion of birds in zoos are captive bred and are often exchanged between collections as part of managed breeding programmes. This is not the case for fish; the purchase of fish, particularly marine fish, and invertebrates from wild sources is still a common and accepted practice. Although this is often raised as an area of concern both inside and outside the zoo community, wild collection can be done in a responsible, sustainable and ethical manner. When done properly, wild collection can even be a valid conservation tool for species and habitats.

Recognising marine fish as wildlife

Aquariums may have been hiding behind the fact that many species in our collections are exploited by commercial fisheries, i.e. compared to the hobbyist market, public aquariums are minute consumers. Between 1.5 and two million people worldwide are believed to keep marine aquariums (Wabnitz, 2003) with many more keeping fresh-water fish (Ornamental Aquatic Trade Association - OATA). Another problem may be that fish are usually considered in terms of 'fisheries' and 'stocks' rather than 'wildlife' and 'animals'. It was only in 1998 that the first legislation formally recognised marine fish as wildlife, with the listing of seahorses and their relatives on the Australian Wildlife Protection Act.

The facts facing the oceans are startling; almost 70% of ocean fisheries are either fully exploited or over-fished (UN Food Agriculture Organisation - FAO, 2007). Approximately 95% of the world's marine production depends on coastal ecosystems such as estuaries, salt marshes, shallow bays and wetlands, mangroves, coral reefs and sea-grass beds, which are

vulnerable to destructive fishing practices. Food webs have also been severely disrupted. However, fishing is still central to the livelihood and food security of 200 million people, especially in the developing world, with one in five people dependent on fish as their primary source of protein (FAO, 2007).

Cultured sources

There are equally significant threats to the freshwater environment, including pollution, water abstraction and the introduction of exotics. The 90% of freshwater fish coming from cultured sources do not provide a perfect solution. Some captive bred supplies of fish actually come from farms that have displaced native species or have the potential to do so. Often, species reared on farms for the ornamental trade are kept in substandard conditions, are packed and shipped badly or are in very poor health.

The influence of public aquariums

While the public aquarium sector's use of fish is tiny compared to other extractive industries, it does not make it exempt from considering the sustainability of its practices. The influence of public aquariums is great, with many people deciding to keep a home aquarium because of an aquarium visit. The 140 public aquariums currently in Europe reach an estimated audience of seventy million people a year, meaning our policies and practices have the potential to be extremely far-reaching.

Our search for sustainability and conservation gains through wild acquisitions does not negate the need for aquariums to be actively engaged in breeding and exchanging the animals in their institutions. The Fish and Aquatic Invertebrate TAG was established in 1998 to develop managed breeding programmes and progressed many husbandry advances (e.g. Smith *et al.*, 2004; Koldewey, 2005). This resulted in the first coordinated programmes being established this year (please refer to page 19).

PHOTO ZOOLOGICAL SOCIETY OF LONDON



Approximately 700 marine fish species have reproduced successfully in captivity, with nearly 300 species over multiple generations, as well as many invertebrates. Our efforts can be better focused for conservation, education and research purposes through regional collection planning. Atlantic cod (*Gadus morhua*), while considered 'Vulnerable' (IUCN, 2006), produce about ten million eggs which would challenge the largest aquarium facilities, not to mention the studbook holder and even ZIMS! There are, however, 13 species that are 'Extinct in the Wild' where aquariums have the ultimate role to play.

How and where to acquire animals

Public aquariums have a complex set of issues to consider when determining how and where to acquire their animals. As one example of how to approach this, below a policy established by the Zoological Society of London (ZSL) and the issues associated with it are outlined below.

The proposal for a major new aquarium in London, 'Biota!', prompted ZSL to develop a sustainable acquisition policy to ensure the sources of all animals were ethically and sustainably acquired. This built on the existing ZSL policy and also incorporated approaches from other available guidance (e.g. the British and Irish Association for Zoos and Aquariums Animal Transaction Policy, 2004) and examples from other individual institutions (e.g. Monterey Bay Aquarium and the National Aquarium in Baltimore, USA). This policy complements the institutional collection plan and consideration of health and welfare issues associated with acquiring and transporting species.

The framework for sourcing species is shown in Table 1, broadly dividing these into wild caught and captive bred sources. The order of the sources does not represent a hierarchy of desirability. Where more than one source is available for a species, the source that maximises the conservation benefit should be prioritised. Any animal from sources that do not meet the criteria cannot, under any circumstances, be included in the collection.

Table 1. Categories of acquisition of aquarium species

WILD CAUGHT	CAPTIVE BRED
a) Ecologically sustainable trade - Certified trade - Non-certified trade b) Wild-caught population rescues c) Locally collected d) Customs seizures	a) On-site breeding b) Public aquariums and other professional institutions c) Advanced hobbyist bred d) Aquaculture and mariculture - Native species fish farms - Exotic species fish farms

Wild caught acquisition options

a) Ecologically sustainable trade

In situations where the capture of fish stocks from local areas is monitored and regulated, and where there is no damage to the habitat while providing income for the local community, such trade can be considered environmentally sustainable and beneficial.

- Certified trade

For example, certification through the Marine Aquarium Council (see page 28) for tropical reef fishes and invertebrates.

- Non-certified trade – regular acquisitions

There are a number of other suppliers who, while not part of the scheme to date, may already have standards that equate to MAC or are close to meeting those standards. This includes a number of freshwater ornamental fisheries that are applying sustainability criteria to their practices. However, in the absence of independent certification, before any wild caught stock can be obtained through a specific programme it must be appraised by ZSL to ensure that it meets acceptable standards of evaluation and enforcement. It is recommended that each supplier be assessed on a case-by-case basis, using the MAC standards as guidance.

- Non-certified trade – limited acquisitions for brood stock

These are wild animals that are acquired by ZSL for the express purpose of establishing a captive breeding population requiring a single or limited number of collections from the wild. This acquisition route can be considered, provided that the following is true:

- A clear and detailed breeding plan is developed beforehand.
- The species is ethically captured, packed and shipped (using guidelines outlined above).
- The number of specimens is kept to the minimum viable number to establish a breeding population in captivity.
- The species is considered important to the collection plan for conservation, research or education.
- There is reasonable cause to believe there is no significant impact on wild populations.

b) Wild-caught population rescues

Wild fish that have been acquired for specific conservation initiatives, which fall into the 'rescue' category or for research purposes under the Regional Collection Plan (RCP) guidelines are not considered a compromise on the acquisitions policy, provided they were acquired in an ethical way with the permission of relevant legal/government bodies and have a clear series of goals and objectives for their management in captivity.

c) Locally collected

Local species could potentially be collected directly by ZSL staff under the appropriate licences and permissions. Since they are often difficult or impossible to breed in captivity, continuing collection is likely to be necessary, and the impact to wild populations or habitat must be carefully considered and monitored. In this case we defer to the agencies responsible for the species to confirm that the collection is sustainable.

d) Custom's seizures

There are routinely seizures of fishes and other animals and plants by HM Customs due to paperwork discrepancies, welfare violations or other illegalities. However, ZSL has already developed a working relationship with HM Customs to receive corals and seahorses. This has helped reduce trade legislation violations for CITES listed species, due to ZSL support for species identification and providing guaranteed housing for seized animals, enabling HM Customs to search and seize more illegal shipments. Other species offered

by HM Customs will need careful consideration to ensure that the disease risks of animals with unknown backgrounds can be managed, as well as the cost of rehabilitating animals that are often seized in poor condition.

Not recommended source

Hobbyists frequently offer to donate fish that have outgrown their home aquariums. If the donor does not know the origin of the fish and so cannot pass this information on to the receiving institution, the fish should not be considered. Receiving fish in this way inadvertently contributes to the trade in unsuitable fish because it gives an 'out' to the original purchaser. Thus ZSL does have an obligation to support initiatives that are working to restrict the trade of such unsuitable animals.

Captive bred acquisition options

Due to the problems associated with aquaculture of many fish species, we decided that suppliers of captive bred animals must also go through a rigorous evaluation process, as is the case with wild caught supplies before they are considered acceptable.

PHOTO HEATHER KOLDEWEY/ZSL



a) On-site breeding

On-site breeding applies to species that are currently in the London Zoo Aquarium collection. Facilities at ZSL have the capacity to breed many species for the Silvertown Aquarium. In some cases in-house captive breeding is the most sustainable method for stocking. Three factors must be considered with any in-house captive breeding initiative: source of brood stock, deacquisition of surplus and long-term genetic viability of the population.

b) Other professional zoo and aquarium sources (including universities)

The donation or exchange of captive bred animals from other zoos and aquariums is already common practice. This practice promotes cooperation between facilities, helps deal with issues of surplus stock, ensures high standards of welfare and forms a larger total population in the case of conservation programme species.

c) Advanced hobbyist bred

The hobbyist sector, including fish clubs and societies, breed many fish. These organisations have members with much expertise that often

dedicate themselves to specialising in one group of fish. Their standards of care are usually excellent hence the good breeding results. This is regarded as a legitimate means of acquiring species provided the club or individual is known and has documented high standards.

d) Aquaculture and mariculture

Commercial fish farms to supply the ornamental trade or for food are being developed internationally. Standards for certification of marine ornamental aquaculture and mariculture, including coral farms are being developed by MAC. However, in the absence of certification schemes (particularly for freshwater species) ZSL needs to assess farmed sources species on a case-by-case basis against its own criteria.

- Native species fish farms

Native species fish farms are defined as those that culture species that are native to the country where the fish farm is found. These farms should be the first consideration for aquaculture species; providing they meet the criteria described above, or are certified.

- Exotic species fish farms

Exotic species fish farms are fish farms that culture species not native to that country. Farms that are on a small scale, have high standards of practice and yield healthy fish can be considered acceptable for ZSL, provided they meet the criteria described above or are certified.

The issues

Implementing a policy is always a test of its likelihood to be successful. Since establishing the criteria in 2005 some trial imports from different sources have been conducted. The main issues have been:

- Where there is no certification scheme there will be a degree of subjectivity because there is no independent assessment.
- Suppliers change practices over time and so must be constantly monitored.
- Sustainable practices do not always equate to the healthiest fish, particularly from sources that are new to exporting ornamental fish.
- There is a balance between the issues of welfare of fish handling and transport, and the capture impact sustainability.

A key component of developing a strong and improved sustainable acquisition policy for fish and aquatic invertebrates relies on documenting not only the source of animals, but also the rationale for choosing a particular supply chain. By doing so, a record of suppliers, their methods and livestock quality will be created, which will facilitate future decisions. Working with suppliers that are willing to improve their sustainability is a positive way of affecting change within the aquatic trade, rather than simply rejecting them without discussion. Each acquisition must be thought through and planned on a case-by-case basis in order to ensure that the methodology provides the most sustainable means of keeping and maintaining animals long-term. •

Mobilising the public towards sustainable use of the ocean



Philippe Valette, co-chair World Ocean Network, NAUSICAA Centre National de la Mer, Boulogne-sur-Mer, France

There is only one World Ocean. It covers 72% of the Earth's surface and plays a vital role in the world's social, economical and environmental balance. It regulates the climate and is a source of oxygen, food and energy. The main objective of the World Ocean Network (WON) is to inspire the widest possible audience on a worldwide scale to engage in new behaviours that respect the environment and thus promote intelligent and sustainable use of the World Ocean.

Established in November 2002, WON is comprised of organisations focusing on the general public and committed to concrete actions, including aquariums, science centres, museums, charities, non-government organisations (NGOs) and educational and environmental organisations all over the world. Professional associations such as the European Union of Aquarium Curators (EUAC) and the European Network of Science Centres and Museums (ECSITE) have participated in the foundation of WON and its activities.

Global Forum on Oceans, Coasts and Islands

WON is part of the Global Forum on Oceans, Coasts and Islands, formalised during the 2002 World Summit on Sustainable Development in Johannesburg, South Africa. This entity serves as a multi-stakeholder forum for cross-sectorial discussion, policy analyses as well as mobilisation of knowledge and other resources to achieve the full implementation of international agreements related to oceans, coasts and Small Island Developing States (a coalition of small island and low-lying coastal countries that share similar development challenges and concerns about the environment, especially regarding their vulnerability to the adverse effects of global climate change).

A common good and legacy

Participants and partners of WON share their experience and best communication practices to inform the general public about the state of the ocean, its role in conservation actions and its relation to the natural environment. These organisations also create joint information and education tools and campaigns to promote public commitment. To reinforce a sense of common identity and an individual and collective responsibility all over the planet, WON has forged a new vision: 'the Blue Planet – the World Ocean', a common good and legacy of mankind, a territory without frontiers but with its own identity, for which everyone is responsible. This common effort includes:

- Annual celebration of World Ocean Day on 8 June and its official UN designation as an international day (www.theoceanproject.org/wod). The World Ocean Day has been observed by over 174 organisations in more than 12 countries in Europe and celebrated under the aegis of the UNESCO Intergovernmental Oceanographic Commission in more than fifty countries.
- Fostering the sense of stewardship through the promotion of ocean citizenship. With the 'Citizen of the Ocean' passport, citizens acknowledge a new country, the World Ocean. The passport provides inspiration and ideas for simple conservation actions and demonstrates the determination of its holders to act for the benefit of the marine environment.
- Public mobilisation through campaigns on specific issues, e.g. sustainable seafood consumption and maritime safety.
- Organisation of more dialogues and public debates with scientists, policy and economy decision-makers and the general public.
- Enhancement of involvement of young people in the ocean stewardship and governance as future decision makers, consumers and users of marine resources. Young people can actively participate and contribute to international maritime affairs via the International Youth Parliament for the Ocean (5-8 November 2007, Malta) and the European Youth Oceans Forum (27-29 November 2007, Brussels).
- Creation of a 'Capital of the Sea' based on the same principle as the existing EU 'Capital of Culture'.

Participants of WON meet every three years during their international meeting. The last meeting took place in January 2006. The WON participants also assemble at a regional level. The Blue Planet Forum, to be held in Brussels from 27 to 29 November 2007, will be an occasion to refine and advance WON's action plan and an opportunity to discuss with decision makers.

For more information, please also visit www.worldoceannetwork.org •

Did you know that...

- ...the maritime surface area under the jurisdiction of the EU member states is larger than the total land area of the European Union?
- ...almost half of the EU's population lives less than fifty kilometres from the sea, and even more live near water if those living near lakes and rivers are included?
- ...science centres, zoos, museums and aquariums are considered the most reliable sources of information about oceans and seas?



The EUR-OCEANS Public Outreach Policy

Nadia Ounais, Monaco, Paul Tréguer and Sylvain Ghiron, EUR-OCEANS, Brest, France

EUR-OCEANS (2005-2008) is a European 'network of excellence' aiming to better understand and model the impacts of global change on the pelagic marine ecosystem.

The overall scientific objective of EUR-OCEANS is to develop models for assessing and forecasting the impacts of climate and anthropogenic change on food-web dynamics (structure, functioning, diversity and stability) of pelagic ecosystems in the open ocean. To reach this goal, EUR-OCEANS encourages the progressive integration of research programmes and facilities of major research institutes in Europe.

The joint programme of activities includes:

- Integrating activities on networking, data and model integration
- Jointly executing research on pelagic ecosystems end-to-end, biogeochemistry, ecosystem approach to marine resources and within-system integration.
- Training researchers and other key staff
- Undertaking outreach activities directed at the socio-economic and the European public.

Transferring knowledge

The transfer of knowledge to the general public has been identified by EUR-OCEANS as a top-level priority. EUR-OCEANS receives significant financial support from the European Commission and allocates 10% of its funding to its Public Outreach Policy. This shows that marine scientists in Europe realise how important it is to explain general scientific concepts to the public as well as informing people about research discoveries. Public outreach objectives include:

- Making the general public aware of climate change and its impacts on marine ecosystems.
- Strengthening the link between scientists and the rest of society.
- Disseminating the major research findings of EUR-OCEANS to the European public through a network of aquariums and scientific centres, as well as the European Union of Aquarium Curators (EUAC).

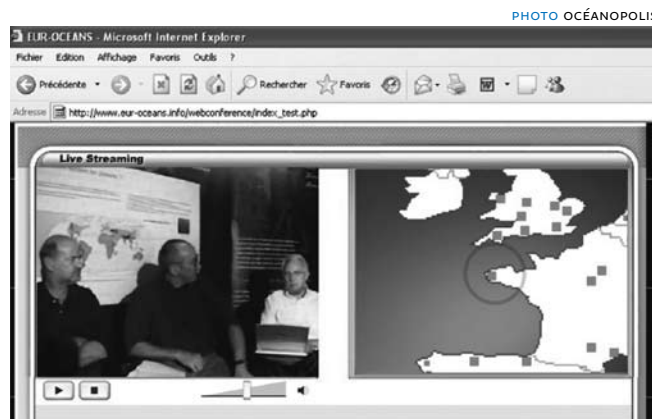


PHOTO C. GUINET

Under the leadership of Océanopolis, Brest, the network is composed of the following members:

1. National Marine Aquarium, Plymouth, England
2. Centre National d'Etudes Spatiales (CNES), Toulouse, France
3. European Union of Aquarium Curators (EUAC)
4. Oceanographic Museum of Monaco
5. Universeum, Sweden
6. Aquarium Finisterrae, Spain
7. Océanopolis, Brest, France
8. Gdynia Aquarium, Poland
9. Acquario di Genova, Italy
10. CretAquarium Thalassocosmos, Greece
11. Zoo Aquarium Berlin, Germany

EUR-OCEANS especially focuses on children and older students, providing schools, high schools and colleges with educational material such as films.



Films

Through its website EUR-OCEANS' provides access to scientific films, most of which are available in both English and French. These films are produced by experts within the EUR-OCEANS' network. So far, priority has been given to produce films illustrating the key issues of the impacts of global warming and the physics, chemistry and biology of the world's oceans and of specific ecosystems.

Educational programme

Educational programmes have been developed annually since 2005 for students in different countries. These programmes are also accessible through the EUR-OCEANS' website. In 2007, for example,

PHOTO OCÉANOPOLIS



participating classes could choose to carry out a project based on the following list:

- Impact of global warming on the Antarctic.
- A scientific cruise of the Polarstern to the Southern Ocean.
- Elephant seal oceanographers (equipped with satellite tags).
- Penguin survey.
- A 4-6 minutes film (storyboard) reflecting the thoughts about the effects of climate change and human activities on marine ecosystems. Students also have access to other resources through the website, such as a media store and online audio-video conferences. For example, one of the scientists directing the programme on 'seal oceanographers' at the Kerguelen and Crozet Islands (Indian Ocean) gave a presentation which could be attended online.

Press conferences and exhibitions

EUR-OCEANS also organises press conferences to raise public awareness. These press conferences with invited researchers are quite successful and are usually covered by the media. The last three conference topics were:

- 'Ocean acidification' in Paris, June 2006.
- 'The Gulf Stream: the end of a myth?' in Saint Malo, October 2006.
- 'How far can we go in manipulating the oceans to reduce CO₂ concentrations in the atmosphere?' in Berlin, June 2007.

Several aquariums are presenting long-term exhibitions on EUR-OCEANS topics, but temporary exhibitions have also been provided during events such as 'National Science Week' in the United Kingdom.

For further information, please refer to the following websites:
www.eur-oceans.info and www.eur-oceans.eu •

JEAN-MICHEL COUSTEAU AND PHILIPPE VALLETTE (2007)

Atlas de l'océan mondial

This French language book describes the link between man and the world ocean and the ecological importance of preserving the world ocean. Objective of the atlas is to challenge and encourage humanity to take action in this. Charts and graphs clarify the need for an overall policy to preserve the ocean as a common inheritance.

Pages: 79. ISBN: 978-2-7467-0942-3 (pb). Price: €15.00.
 To be ordered from: Éditions Autrement
 (www.autrement.com)



MAURICE KOTTELAT AND JÖRG FREYHOF (2007)

Handbook of European freshwater fishes

This handbook with over 870 bibliographic references covers 546 native and 33 introduced species and is a very important contribution on the biodiversity of freshwater fish species in Europe. The book amongst others describes genera and species, methods for identification, habitat, biology and ecology, distribution, conservation status, up-to-date taxonomy and nomenclature.

Pages: 646. ISBN 978-2-8399-0298-4 (hc). Price: €87.00
 To be ordered from: Publications Kottelat
 (E-mail: publications_kottelat@bluewin.ch)



W.E. ENGELMANN (2005)

Zootierhaltung, Tiere in menschlicher Obhut – Fische

This German language book describes both general as well as special aquarium knowledge for professional animal keepers and aquarists, but the book can also be used by hobbyist for ideas and advice. 'Fische' is one of volumes within the Zootierhaltung series. Other volumes cover the basics of keeping game, birds, mammals, invertebrates, reptiles and amphibians.

Pages: 891. ISBN 3-8171-1352-8 (pb). Price: €49.80
 To be ordered from: Verlag Harri Deutsch
 (www.harri-deutsch.de/)



DR. ELIZABETH WOOD AND NICK DAKIN (2003)

The responsible marine aquarist

This book explains the problems in keeping marine tropical fish and how consumers and others involved in the trade can help to raise the standards.

Pages: 154. ISBN: 0-948150-36-x (pb). Price: UK£11.50
 To be ordered from: Marine Conservation Society
 (www.mcsuk.org)



MARTIN SANDER (1998)

Aquarien-technik im Süß- und See wasser

This German language book aims to describe the function of filter elements and lighting-, heating-, and cooling systems, and how they intervene in the biological chemical and physical household of an aquarium. It also describes the function and way of life of bacteria in an aquarium, in relation to the biological filter process. Several technical problems are discussed and information on diverse aquarium plants is provided.

Pages: 256. ISBN: 3-8001-7341-7 (hc). Price: €19.90
 To be ordered from: Ulmer (Eugen)
 (www.ulmer.de)



The EC AquaRing project; a new opportunity

Antonio Di Natale, Acquario di Genova, Italy



The website search engines used by many people to find needed information are commonly based on key-words. But with technological developments the semantic web is a future possibility; it is an evolving extension of the World Wide Web in which web content can be expressed in natural language, as well as a format that can be read and used by software agents, thus permitting them to find, share and integrate information more easily.

Accessible and Qualified Use of Available Digital Resources about Aquatic World In National Gatherings

The European Commission (EC) approved a proposal in 2006 for the development of 'AquaRing', a project focusing on establishing a large online European multilingual access portal as a resource. The main objective is to facilitate access to information on aquatic environments and their resources, with particular reference to preservation and sustainable environmental management. AquaRing's content is provided by European aquariums, natural history museums and science centres. Other objectives are to define the information needs of the different types of public and to identify a method for assessing how effectively the contents are used, as well as the educational effectiveness of the project.

Accessibility to many files

AquaRing will develop this new semantic web site based on sophisticated methodology and a complex ontology, providing access the huge number of existing files (text, presentations, video, images, etc.) which are not yet electronically available. Each file will be annotated with a specific metafile, making the semantic search possible.

The portal will feature different types of access for different user profiles, including the general public, schools and universities, teachers, scientists and researchers, tour operators, museums, aquariums, other scientific centres and journalists. It will have a multilingual interface, a keyword translator for thematic searches, and other services making surfing and consultation easier.

Project participants

'AquaRing' is funded within the EC e-contentplus programme and is carried out by a consortium of nine partners, coordinated by Costa Edutainment S.p.A. (Acquario di Genova, Italy). The consortium consists of Nausicaá (Centre National de la Mer, Boulogne-sur-Mer, France),

the Royal Belgian Institute of Natural Science (Brussels, Belgium), the Lithuanian Sea Museum (Klaipeda, Lithuania), Rotterdam Zoo (the Netherlands), Ecsite (Brussels, Belgium) and the Department of Anthropological Science of the University of Genova (Italy). Together with Acquario di Genova, these scientific partners also are the website contents providers. Two important technical partners are the Fundación Robotiker (Zamudio, Spain) and the Softeco Sismat (Genova, Italy), who are in charge of developing the technical infrastructure and the semantic system. The World Ocean Network (see page 33) is also cooperating with AquaRing, to ensure a worldwide dissemination of this project.

Technical complexity

The huge complexity of the aquatic domain, with many correlated issues and sciences and the limited availability of existing ontologies, make the construction of the thesaurus and the related semantic web links extremely difficult. The system should be powerful, flexible, and capable of constant evolution as the system itself as well as the availability of additional ontologies and knowledge improve.

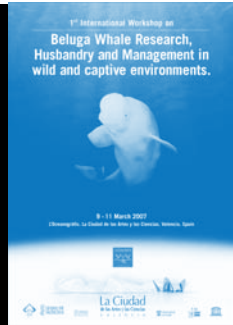
The final goal of AquaRing is to demonstrate that the development of new web tools, such as this semantic approach, will improve search possibilities and will make many new contents available to tool users. The many different competences in the AquaRing consortium are necessary to ensure a strong basis to support this effort to provide a future high level searching tool to aquaria, zoos, natural history museums, science centres, scientists, protected areas, media, teachers, students and the public at large. The project deadline is March 2009.

For further information and updates on the AquaRing project, please refer to the website: www.aquaringweb.eu/ •



Beluga whale experts meet at L'Océanografic

Manuel Castellote, L'Océanografic, Valencia, Spain



With some aquariums displaying beluga whales (*Delphinapterus leucas*) and six polar countries managing beluga populations, there was a clear need to share information on research, husbandry and management practices. To achieve this, beluga whale experts from around the world met in March 2007 for a series of three workshops on beluga whale research. As L'Océanografic, Valencia has two beluga whales – which are the subjects to active research since 2003 – it was a suitable host for the workshops.

L'Océanografic organised the 'First International Workshop on Beluga Whale Research' with the aim of bringing together many experts working with belugas both *in situ* and *ex situ*. The ultimate goals were to promote long-term sustainability of beluga populations in the wild and to maintain a healthy, self-sustaining population of belugas in public aquariums that can aid in research and public education efforts.

A broad collaboration

Over 120 people from 15 countries participated in the workshop. This included researchers and managers from Arctic countries such as Russia, Canada and the United States, as well as native hunters, veterinarians, oceanographers, ice experts, curators and representatives from environmental organisations. Information on the breeding biology of beluga whales that reproduce in aquariums was compared with what is known about reproduction in the wild. However, many questions still remain unanswered and require further study, but the workshop took the first steps towards promoting a broad collaboration. L'Océanografic aims to encourage this in forthcoming years and subsequently outlined a document that provides ideas to build the capacity for collaboration and suggests potential areas for collaborative research.

Detecting climate change effects

The second of the three workshops was organised by the U.S. Marine Mammal Commission. This workshop aimed to develop a circumpolar monitoring programme for beluga whales and ringed seals (*Phoca hispida*), to detect potential effects of global climate change on both species and their ecosystems. Environmental conditions in the Arctic are changing rapidly and this is expected to affect both terrestrial and marine ecosystems. The projected decrease in Arctic ice may also bring an increase in shipping, fishing and other activities that could impact Arctic ecosystems. Ringed seals and beluga whales were chosen as subjects for monitoring programmes as both species have strong associations with ice and any changes in the sea, pattern and timing of ice formation and decay are expected to affect the seasonal and long-term distribution of the species. Ringed seals depend on ice for reproduction and beluga whales' seasonal migrations are strongly tied to patterns of ice coverage as they must



PHOTO JAVIER YAYA

overwinter in areas with reliable open water. Furthermore, both species have a circumpolar distribution, are important to native communities across the Arctic and reasonably good data are available on their historic and current status in certain areas.

Belugas sampling the oceans

The third workshop was organised by the Greenland Institute of Natural Resources. During the workshop an International Polar Year project was launched, aimed at tracking movements of beluga whales via satellite telemetry. The project will correlate the locations of beluga whales with sea ice coverage and oceanographic data collected by remote sensing. This information will serve as a baseline to study future changes in the area. Some beluga whales may be fitted with special tags that will collect oceanographic data during their deep dives. These whales will effectively serve as 'autonomous underwater vehicles' sampling the water column for temperature and salinity, information that can be difficult or impossible to collect in some locations in winter. For example, on the west coast of Greenland the whales over-winter in an area of reliable open water that is of particular interest to climate change scientists because it is considered to be an important area for heat exchange between the ocean and the atmosphere. Collaboration between beluga whale biologists and oceanographers could provide valuable new information to better understand climate change.

For more information about the workshops, please refer to http://sitios.cac.es/microsites/belugas_workshop/ •

CORALZOO; an update

Ronald Osinga, Wageningen University, The Netherlands

CORALZOO is a European Union funded research project, executed for the benefit of EAZA members. The main aim of the project is to improve the methodology for breeding and husbandry of hard (stony) corals (*Scleractinia*) applied in zoos and public aquariums. The project was initiated in 2005 and will continue until 2009. This article summarises the main achievements of the first two years of the project. For a further outline, background and the objectives of the CORALZOO project, please refer to EAZA News 52 (page 10-12).

Coral nubbins

A generic bioassay has been developed and validated. This bioassay uses coral nubbins (single to few polyp fragments), which are attached to a flat support. These nubbins generally show a two-dimensional growth pattern during the first months of their development, which allows easy monitoring of growth-related parameters and the execution of quantitative studies with a limited amount of coral material. A step-by-step protocol for this method was published (Shafir *et al.*, 2006).

A series of over one thousand nubbins obtained from ten genetically different colonies of *Stylophora pistillata* was prepared in Israel and successfully shipped to seven CORALZOO partners in Europe for comparative growth studies and health monitoring. A shipment protocol was developed using experience gained during this exercise. Furthermore, a comparative study was done on wet and dry transportation methods for corals, which indicated that dry transport is less expensive, hereby

taking into account a slightly higher mortality rate during dry transport. Consequently, a transportation protocol was elaborated.

Asexual breeding; fragmentation studies

A study was initiated to optimise techniques for fragmentation (asexual reproduction) of corals. An analysis of the existing coral culture systems used by CORALZOO team members revealed that considerable heterogeneity currently exists among systems, in particular with respect to light availability and water movement. Systems were modified accordingly and optimal sample sizes for comparative fragmentation studies were determined for seven coral species. These studies are still in progress.

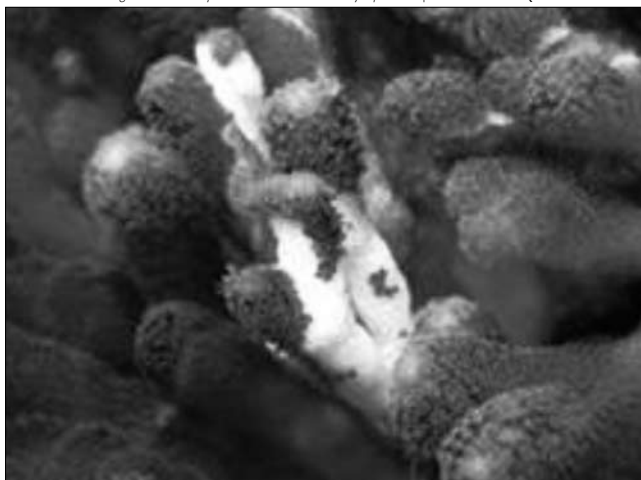
Sexual propagation

The reproductive cycle of *Stylophora pistillata* in the Red Sea was studied extensively. Based on these observations, a procedure for controlled production of sexually derived propagules was elaborated by bringing captive bred, reproductive colonies of *Stylophora pistillata* into a sea-based nursery, where spawning followed the natural cycle (Amar and Rinkevich, 2007). Procedures for collection, settlement and subsequent handling of the planula larvae were established.

Abiotic factors

The relationship between water flow and coral growth was studied for a series of genetically identical colonies of *Galaxea fascicularis*. Growth was highest under the highest flow applied (~25 cm/s), whereas total absence of water movement caused the corals to decline after an initial period of (slower) growth. No difference in growth was observed between corals grown under unidirectional flow and corals grown under alternating (bi-directional) flow.

Fig. 1a. White syndrome affected on *Stylophora* sp. PHOTO DOMIQUE BARTHELEMY



A similar study was conducted to test the affect of light intensity on the growth of *Galaxea fascicularis*. Clearly, these corals grew fastest at a light intensity of $440 \mu\text{mol m}^{-2} \text{s}^{-1}$, which is higher than what is generally advised for optimal growth of corals ($200\text{--}300 \mu\text{mol m}^{-2} \text{s}^{-1}$). The economics of two lighting types (T5 and metal halide) for coral breeding was evaluated. Preliminary results indicated a significantly lower energy demand (per volume of coral produced) for T5 lighting.

'Fed corals are happy corals'

A considerable amount of work has been carried out on coral feeding. The results provide further evidence for the new dogma that 'fed corals are happy corals'. The effect of different food types (phytoplankton such as *Nannochloropsis* spp., zooplankton like *Brachionis* and *Artemia*, and dry fish food) on the performance of *Stylophora pistillata* and *Pocillopora damicornis* was studied. Addition of *Artemia nauplii* enhanced the growth of nubbins of *Pocillopora damicornis* and changed the biochemical composition of *Stylophora pistillata* considerably. The microalga *Nannochloropsis* was captured by *Pocillopora damicornis*, but did not enhance growth. High quantities of *Brachionus* enhanced growth, but the effect was smaller than the effect obtained with *Artemia*. High protein fish food (FF70), when administered appropriately, gave the best results.

No differences in coral performance were found when daytime feeding was compared to nighttime feeding, which indicates that corals are opportunistic feeders and feed whenever food is available. Based on the experiences described above, user-protocols on coral feeding can be simplified. For *Stylophora pistillata*, it was observed that the intra-specific variation in performance between genets was too high to evaluate the effect of the different feeding regimes. This is an important general finding, which demonstrates that trials should include high numbers of replicates from genetically different individuals. Furthermore, the structure of the digestive system of *Stylophora pistillata* was described using histology and histochemistry. The digestive system turned out to be more complex than previously anticipated.

Health control

An extensive survey revealed that two coral disease types occur most frequently in aquariums: white syndromes (Fig. 1a) comprise nearly 70% of the disease records, with brown jelly syndrome (Fig. 1b) being second

in occurrence frequency. 'White syndromes' are here defined as 'a disease-like syndrome characterised by the presence of severe tissue loss from the coral', while 'Brown jelly syndrome' is characterised by tissue death and massive mucus production. The white syndrome records displayed extremely variable rates of lesion progression, as well of patterns of tissue loss. This definition also includes what is commonly referred to, by most professional and home aquarists, as Rapid Tissue Necrosis (RTN) or Shut Down Reaction (SDR). Many of the coral samples showing white syndromes had large proportions of pathogenic *Vibrio* spp. (*Vibrio harveyi*, and few other *Vibrio* strains) associated with their tissue (Luna *et al.*, 2007). The pathogenic role of *Vibrio harveyi* in aquarium corals was convincingly demonstrated; it is the main causing agent of RTN and most likely involved in other white syndromes as well. Fungi are the main suspects with regard to the causation of 'Brown jelly syndrome'.

Two studies on treatment of pest organisms were conducted. They describe effective treatment of *Planaria* flatworms using Levamisol and control of invasive polychaetes by using *Diplodus cervinus* fingerlings.

Morphogenesis

Analysis of the branching and sprouting patterns of growing colonies of *Stylophora pistillata* indicate how these processes lead to the overall morphology of this species (Shaish *et al.*, 2007). Analyses revealed plastic morphometric characters at branch level, and predetermined morphometric traits at colony level. Therefore, under the experimental manipulations of this study, phenotypic plasticity in *Stylophora pistillata* appears to be related to branch level of organisation, whereas colony traits are controlled by predetermined genetic architectural rules. Based on these studies, a mathematical model was developed that is centered on the concept of signaling molecules. The model is still in the development phase, but it already describes the qualitative process of astogeny in *Stylophora pistillata* as well (Fig. 2).

Produced protocols will be disseminated through the CORALZOO website (www.coralzoo.net; under construction) and through publication in international journals. It will be attempted to transform all available and newly obtained knowledge on coral breeding and husbandry into a user-friendly format; the CORALZOO Book of Protocols, which will become publicly available at the end of the project. •

Fig. 1b. Brown jelly syndrome affected colony of *Euphyllia ancora* PHOTO NURIA BAYLINA

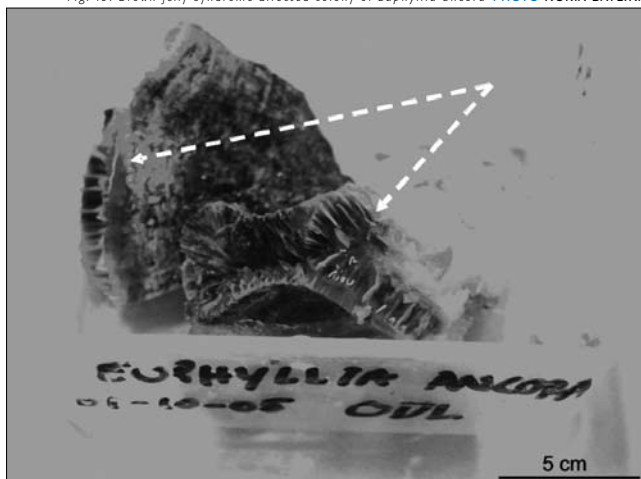


Fig. 2. Modelled growth of *Stylophora pistillata* PHOTO ANDREAS DEUTSCH AND MICHAEL KUECKEN

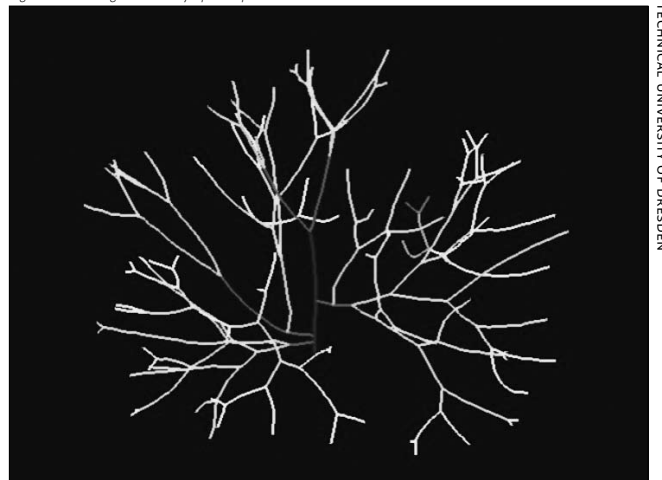


PHOTO RAMON VILLASVERDE/COLUMBUS ZOO AND AQUARIUM

PHOTO DIRK PETERSEN



Coral sex as conservation tool

Dirk Petersen and Michaël Laterveer, Rotterdam Zoo, The Netherlands, Mike Brittsan, Columbus Zoo and Aquarium, Ohio, United States of America

In addition to developing techniques for sexual reproduction of corals in public aquariums as a tool for management, the SECORE (SExual CORal REproduction) project aims to create a neutral platform for collaboration between public aquariums and researchers to promote coral reef conservation.



Project SECORE was initiated by Rotterdam Zoo in the beginning of 2002 when the new Oceanium with its marine laboratory officially opened. Because of this new opportunity, the zoo sought a progressive research project with a strong marine conservation background. Tropical coral reef aquaria are popular exhibits in modern public aquariums, however, coral reefs are rapidly declining around the globe. While asexual propagation of primarily branching corals is now a standard technique to propagate corals in captivity, sexual reproduction had been a randomly observed and relatively poorly studied event in aquaria since the beginning of this century.

An update

Five years after initiation, SECORE now has more than forty members in Europe, the United States of America (USA) and Japan. The EUAC/ EAZA FAITAG Coral Aquatic Sustainability Programme (ASP), with Dirk Petersen as one of the co-chairs, has supported SECORE since its inception. The Coral Reef CAP (Conservation Action Partnership) of the American Association of Zoos and Aquariums (AZA), chaired by Mike Brittsan, also plays a pivotal role. Not only has SECORE developed into an important initiative within the public aquarium community, an increasing number of scientists in the broad field of coral conservation have also been joining the network. The combination of research and practical aquarium management, together with workshops focusing on staff training and public outreach, has led to serious progress in the field of coral reef conservation (please also refer to EAZA News 57, p28).

The main focus

Currently, the main focus of SECORE is the threatened Elkhorn coral

Acropora palmata in the Caribbean region. This species, in dramatic decline and listed under the U.S. Endangered Species Act (the first coral species ever that has officially been listed as threatened), represents an ideal example on how project SECORE and public aquariums may contribute to coral conservation. Two field workshops, in 2006 and 2007, organised by SECORE, led to important steps for conserving this key Caribbean species, which was previously a dominant coral in shallow and wave exposed reef habitats. As a result of these workshops, more than 800 Elkhorn coral recruits have been established in aquariums in Europe and the USA.

Mary Hagedorn, leading cryopreservation specialist of the Smithsonian Institution (USA) and SECORE member, took major steps towards cryopreserving sperm cells of the Elkhorn coral during the recent workshop in Puerto Rico (1-8 August 2007). Besides using public aquariums as a kind of Noah's Ark for establishing *ex situ* breeding populations of endangered species, cryopreservation technology can be an essential tool for preserving genetic diversity. These *ex situ* conservation strategies might be the only chance to prevent coral species from extinction in times of rapid change, just as they serve as a safeguard for terrestrial species.

It is believed that the public aquarium community can provide a stable and non-competitive arena for experts in the field to work together. It is expected that SECORE members will become engaged in other regions, e.g. the Indo-Pacific, as the project develops. •

For more information, please refer to www.secore.org

The 11th International Coral Reef Symposium will be held in Fort Lauderdale, Florida, USA, from 7 to 11 July 2008.

The symposium is devoted to the best reef science available, with the purpose of sharing scientific findings with government agencies, resource management, and non-government organisations throughout the world. For more information, please refer to www.nova.edu/ncri/11icrs/index.html



Life support systems for aquariums

Martin Sander, Erwin Sander Elektroapparatebau GmbH, Uetze-Eltze, Germany

In recent years many large aquariums with water volumes of several thousand cubic metres have been constructed in Europe. Diverse animals from all the world's oceans live in these aquariums, e.g. corals, jelly fish, ornamental fish, sharks, tunas and marine mammals and birds. Each organism has its specific requirements regarding the design of the life support system. The most important and also decisive issue in the design is the objective of the aquarium. Therefore standardisation of the technology is nearly impossible. However, the main steps in engineering and aquarium design are described below.

Main steps in engineering

Architectural concept

A preliminary architectural concept shows the thematic structure, approximate sizes, location and type of construction of the tanks, as well as the dimensions and location of the installation rooms.

Tank list

This is a table in which all aquarium tanks are listed. Small tanks are often left out because they seem irrelevant. However, logistically, a small tank requires the same supply and outlet connections as a very large tank. Description of functional features of each tank is also very important.

Definition of the circulation systems

One can easily use the above table to identify which tanks can be placed in groups using the same circulation system. What type of water, e.g. fresh or seawater, cold or warm water, also needs to be considered. This exercise enables the operator and the technical engineer to specify how many different circulation systems are needed.

Location and dimensions of installations rooms

The installation room should be located close to the aquarium tanks. This saves installation, operating and service costs. The access to the installation rooms must be wide enough for an easy exchange of pumps and filters in the coming years.

Aquarium design - scope of supply

Flow chart

A flow chart visualises the logical combination between tanks and the life support system. It also shows the functional configuration of tanks and life support systems and their components.

Layout of the pipe system

The architect can use the flow chart to include a pipe system in the drawings. Both designs have to match in order to find an acceptable pipe pathway.

Hydrodynamic configuration of the pipe system
The lay out of the pipe system can be used to determine the length, diameter and number of fittings needed. Usually pipe systems are configured so that the water is pumped in, but is discharged using gravity.

Illumination design

The illumination of aquariums is based on requirements of the species kept. Tropical seawater tanks with invertebrates require an extremely bright light, while cold water systems scarcely need any light.

Scheme of electrical energy

Which pumps are needed is determined based on the flow chart and the configuration of the pipe system. These data are considered together with all other electrical components. The power demand and the thermal relevant term of the energy input have to be considered. Greater heights and more powerful pumps also create higher maintenance costs.

Thermodynamic calculations

Water temperatures can be calculated based on the tank configuration. These temperatures have to be maintained even under extreme conditions. For this purpose it is necessary to have the specifications for the room's air-conditioning system. The following factors need to be considered in the thermodynamic calculations:

- thermal transmission through walls, floors, panels and surfaces;
- heat introduction from the illumination;
- heat introduction from the operating pumps and compressors;
- and if required, heating or cooling the complete water volume.

Tank currents

Depending on the animals kept, it might be necessary to produce an additional water current inside the tanks. This can be achieved by either internal or external pumps.

Switchgear

Big aquariums necessarily require a central switchgear in which all information is gathered and controlled via Programmable Logic Control (PLC). Its software is the brain of the system; it collects all information from the tanks and life support systems and evaluates them, and produces warning signals and diagrams if required. The software can be connected to a telephone line that transmits signals to external users.

When designing large aquariums it is necessary to calculate different concept approaches in order to get as close as possible to the limits and possibilities of the whole system. •



Trends in North American aquariums

Karen Furnweger, John G. Shedd Aquarium, Chicago, Illinois, United States of America

ASSOCIATION
OF ZOOS &
AQUARIUMS

North American aquariums serve a large and diverse audience – 17 of the leading public aquariums in the United States of America (USA) and Canada reported 2006 attendance totaling 17,286,221. This includes schoolchildren, families, English and non-English speakers, recreation seekers, the environmentally concerned – or not – and combinations thereof.

To entertain and educate, fulfill conservation and social missions and earn the revenue to operate and innovate, North American aquariums are trending along parallel courses in such key areas as exhibits and guest experience, animal acquisition and care, environmentally friendly or 'green' business practices, community outreach, and on-line presence.

New exhibits emphasise accessibility and interactivity

Touch programmes, whether at stingray pools for general visitors or revenue-generating individual encounters with high-profile animals such as beluga whales, help create or deepen a connection with animals. To satisfy the public's desire for new experiences, drive repeat visits and encourage membership renewal, many aquariums create new special exhibits each year. And to capture the young family demographic, aquariums are designing both special and permanent exhibits specifically for children, with kid-height displays and play areas, as well as graphics and hands-on activities that encourage two or more generations to learn together.

"There's a real call and clamour for more interactivity and opportunities for play during the visit," said Kevin Mills, president and CEO of the South Carolina Aquarium, which recently launched a successful pilot programme called 'Something's Fishy', an interactive mystery activity for children and their parents involving maps, 'decoders' and staff in detective costumes. Vancouver Aquarium's new 'Clownfish Cove' allows preschoolers to crawl through specially built exhibits to fishes all around them. Meanwhile, Monterey Bay Aquarium's 'Splash Zone', described as "the first children's museum inside an aquarium," will soon expand to encompass much of the facility's second floor, including its signature kelp



forest exhibit and other major habitats. It will have age-appropriate areas for children ranging from infants to 12-year-olds.

Attracting a Spanish speaking audience

Aquariums in the USA are working hard to attract the rapidly growing Spanish-speaking audience, with bilingual front-line staff members, advertisements in Spanish-language media and promotions tailored to the community's buying habits. Monterey Bay has seen its California-resident Hispanic attendance increase 40% between 2006 and 2007. The institution hosts annual cultural events including Día del Niño (the traditional children's day in Mexico) in spring, and Fiesta del Mar (Celebration of the Sea), which each autumn honours an environmental hero from Mexico or Central America.

Virtual visitors

Aquariums are also reaching out to the virtual visitors to their websites, in keeping with the trend of interactivity on the internet. In addition to Shedd Aquarium's general website, the institution launched a social-networking site this year. 'Sheddheads.org' is a fan site where people can share digital videos and photos of their aquarium visit, comment on other postings and enter their images in frequently changing contests. By inviting people who are already using YouTube and Flickr to participate in a Shedd-specific site, the aquarium is cultivating a community of citizen marketers. Monterey Bay counts among its web audience people who will never physically visit the California aquarium but can connect with its animals and mission through such on-line offerings as web cams in habitats, podcasts and 'webinars' – live interactive seminars that the aquarium is currently making available to its members.

PHOTO BARBARA BERGWERF



Going 'green'

Aquariums, along with zoos, have long been the standard-bearers for conservation through their exhibits and research. Recently many have moved to the forefront of a more general trend and adopted environmentally friendly, or 'green' business practices, nowhere more apparent than in new construction. In November 2006 Vancouver Aquarium opened Aquaquest, a 5,000 m² learning centre that is the first aquarium building in the world to be certified with a gold rating under the international LEED (Leadership in Energy and Environmental Design) standard for green buildings. Energy-efficient and environmentally friendly features include a radiant cooling system chilled by the aquarium's circulating seawater; low-VOC (Volatile Organic Compounds) building materials and Vancouver's first 'green wall' planted with native hardy plants that will insulate the building summer and winter as well as attract insect and bird life. Older aquariums are going green too. Shedd Aquarium was Chicago's first public building to resurface its roof with a soybean-oil-based coating. The nontoxic reflective white surface has significantly cut Shedd's air-conditioning costs and is a model for combating the 'urban heat island effect' – elevated temperatures citywide from traditional black asphalt roofs.

Sustainable seafood

Another conservation issue aquariums have made their own, through external messages and internal practices, is sustainable seafood; seafood species whose stocks are abundant, well-managed and caught or farmed in environmentally friendly ways that do not impact non-targeted species or aquatic habitats. Monterey Bay has been the leader with its decade-old Seafood Watch programme to raise consumer awareness about the importance of buying sustainable seafood, through its website and a printed pocket-sized seafood guide. Monterey Bay has shared its extensive fisheries research to help other aquariums develop their own regional seafood guides. The South Carolina Aquarium established a partnership with local fishermen (many of whom are facing fierce competition from imports), seafood purveyors, retailers and more than eighty high-end restaurants in the Charleston area, to create a local sustainable seafood movement that benefits both the coastal ecosystem and the fishing industry. Because public aquariums often use commercial sources to obtain species that have yet to be bred successfully in captivity, many have instituted policies mandating sustainable acquisition from the wild as defined in guidelines developed by the Marine Aquarium Council (see page 28).

In-house propagation

Whereas the life histories of some marine fishes pose challenges to in-house propagation, many cetacean species breed readily in aquariums, despite the need to move these large animals between facilities. Research into artificial insemination methods for Pacific white-sided dolphins and belugas, conducted by Sea World and Shedd Aquarium, could eventually leave the travel to vials of cryogenically preserved semen. Jill Allread, a Chicago-based communications specialist who monitors animal issues in North America and globally, said: "North American aquariums are aggressively doing breeding programmes with populations of bottlenose dolphins, Pacific white-sided dolphins, killer whales and belugas that

are already in public display facilities because the importation of those animals is closely scrutinised by law as well as by animal activist groups that do not want any animals taken out of the wild."

She noted that the death of two whale sharks at the Georgia Aquarium raised a lot of questions about which species can do well in a public display facility. "But to Georgia Aquarium's credit," she said, "they broke new ground with a species that has not been on display here, much as years and years ago, no other marine mammals were on display in accredited or high-quality facilities. As whales and dolphins have been added to aquarium collections, we have learned about their physiology, reproduction and health needs, not only so that we can maintain healthy zoological populations but also so that we can rehabilitate stranded animals and get them back into their natural habitats. The work that aquariums are doing and the data they are collecting will also factor into whether we can save wild populations if they get to a tipping point, and many indications are that they will get to a tipping point."

Myripristis jacobus PHOTO BRENNNA HERNANDEZ/SHEDD AQUARIUM



Veterinary issues

Aquatic veterinary medicine is rapidly approaching the sophistication of its well-established terrestrial counterpart, and Sea World, Georgia Aquarium and Shedd boast large, state-of-the-art animal hospitals with functions that compare with human facilities. Shedd conducts annual wellness exams for its marine mammals, birds, reptiles, monkeys, sharks, rays and other fishes that are physically and temperamentally suited to the procedures. The emphasis on maintaining healthy, long-lived collections through preventive practices has opened a new field; geriatric veterinary medicine. From dental problems and arthritis to cancer, aquatic-animal veterinarians are treating a variety of age-related medical conditions as well as discovering more about the physiology of their myriad patients.

A trend for the human element as aquariums – and zoos – adopt a more corporate business model is professional development and especially leadership training. During his term as president of the Association of Zoos and Aquariums, Shedd's president and CEO Ted Beattie championed a leadership-training initiative for the national organisation. "We need to very aggressively build a large pool of candidates who have both the skill and the interest in managing these institutions," Beattie said. A recently initiated programme at Shedd, which includes professional development opportunities for all employees, offers an intensive leadership track specifically for managers. "We need to identify and groom our leaders today," Beattie said, "to ensure the success of our aquariums in the future." •

COLLECTION PLANNING

PROGRAMME UPDATES

As approved by the EEP Committee

CHANGES TO
EXISTING TAGs

EAZA Felid TAG

Alexander Sliwa (chair), Koln
12 September 2007

EAZA Hornbill TAG

Koen Brouwer (chair),
Valencia-Parque (institutional
support Fuengirola)
12 September 2007

NEW EEPs

Roan antelope EEP

(previously ESB)
(*Hippotragus equinus*)
Klaus Brunsing, Hannover
12 September 2007CHANGES TO
EXISTING EEPs

Arabian oryx EEP

(Oryx leucoryx)
Jackie Ossowski-Mackie, London
1 August 2007

Black rhinoceros EEP

(Diceros bicornis)
Mark Pilgrim, Chester
12 September 2007

NEW ESBs

Lechwe ESB

(Kobus lechwe)
John McLaughlin, Fota
12 September 2007

Japanese serow ESB

(Naemorhedus crispus)
Herwig Pucher, Wien-Zoo
12 September 2007

Inca tern ESB

(Larosterna inca)
Tony Durkin, Torquay
12 September 2007CHANGES TO
EXISTING ESBs
West African crowned
crane ESB(Balearica pavonina)
Marc Damen, Overloon
6 September 2007

Tarctic hornbill ESB

(Penelopides spp.)
Nigel Simpson, Bristol
11 September 2007Due to taxonomic changes, the
Yellow-throated laughing thrush
ESB has been renamed to Blue-
crowned laughing thrush ESB.Design and Installation of
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- Cooling Technique
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The EAZA Executive Office received fifteen studbooks in the period between May and September 2007. We are very grateful to all who have contributed to these valuable publications and are happy to have received these in printed format.

For a full list of received publications of interest, please refer to the EAZA website ('Magazine' section).

Please continue to send us your printed publications, so we can incorporate these in the online publications list.

DIRECTORY UPDATES

PERSONALIA

Mr. Hans-Günther Collette is the new director of **Thüringer Zoopark Erfurt**, Germany, as per July 2007. He replaces Dr. Norbert Neuschulz.

Dr. Dieter Rinke is no longer working for **Vogelpark Walsrode**, Germany, as per September 2007.

ADDRESSES & TELEPHONE/FAX NUMBERS

The new contact details for the Swedish Association of Zoos and Aquaria (SAZA) are:

Address: c/o Kolmarden Zoo, Kolmarden, Sweden

Phone: +46 11249084, Fax: +46 11249040

The new phone and fax number for **Tierpark Hagenbeck**, Germany, are:

Phone: +49 4053003310,

Fax: +49 4053003398

TERMINATED MEMBERSHIP

Haus der Natur, Austria (former full member)

Dierenrijk Europa, the Netherlands (former temporary member)

Kyiv Zoo, Ukraine (former full member)

British Veterinary Zoological Society, United Kingdom (former associate member)

RECTIFICATION: in the EAZA Membership Directory 2007, the title of Sven Hammer of **Al Wabra Wildlife Preservation**, Qatar, was not indicated correctly. It should have been Dr. Sven Hammer.

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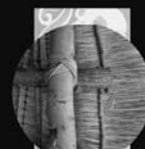
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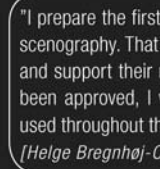
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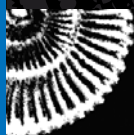


"I prepare the first sketches to visualise the project and fix the scenography. That's how I can illustrate the customer's thoughts and support their needs and wishes. When the drawings have been approved, I will prepare a miniature 3D model which is used throughout the building process"

[Helge Bregnhøj-Olsen, graphic designer]



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WHO

The European Union of Aquarium Curators (EUAC) is a professional organisation for aquarium curators, aiming to actively promote professional improvement between specialists in the public aquarium field. It serves as a platform where experiences, husbandry, new technologies, breeding procedures and educational tools can be communicated and exchanged between members. This organisation was registered in 2000 as a professional union under Catalan law and has since then attained an NGO status.

WHAT

The EUAC was founded in 1972 during the opening of the renewed aquarium in Basel Zoo, Switzerland. Today, the EUAC has 132 members from 90 public aquariums in 25 European countries. Membership of the EUAC is personal and restricted to curators of public and scientific aquariums. Membership is also open to any scientist or other person involved directly or peripherally in the aquarium world, whose contribution in one way or another might be considered to be of help in the development of aquariology.

WHY

The EUAC was founded in order to satisfy the needs of a large number of aquarium curators, to exchange professional knowledge, to share husbandry techniques, to collaborate in cooperative breeding programmes and to support initiatives to raise public awareness about the threat to the many different aquatic ecosystems.

HOW

The EUAC annually organises a congress which is generally hosted by an aquarium. The congress is attended by the majority of the EUAC membership, as well as by observers from aquariums in the USA and observers from industries related to the field of aquariology. Furthermore, the EUAC is an active partner in the International Aquarium Congress (IAC) and co-founder of the International Aquarium Forum (IAF; www.intaquaforum.org), the World Ocean Network (WON) and EUR-OCEANS.

WHERE

The EUAC secretariat is based at the Oceanographic Museum of Monaco

Secretary-general: Dr. Nadia Ounais

E-mail: euac@oceanomc

Website: www.euac.org

PHOTO PURESTOCKX

